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COMMERCIAL BOOKBINDING.

GEO. A. STEPHEN.

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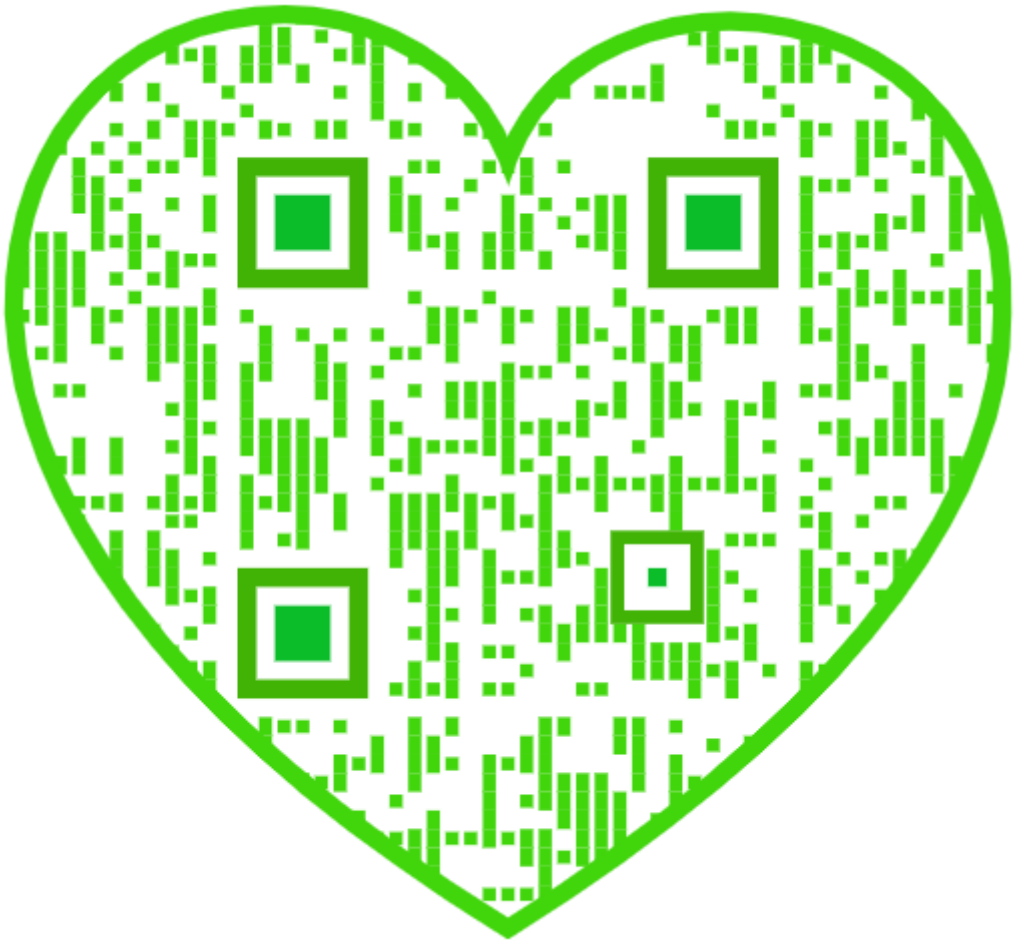

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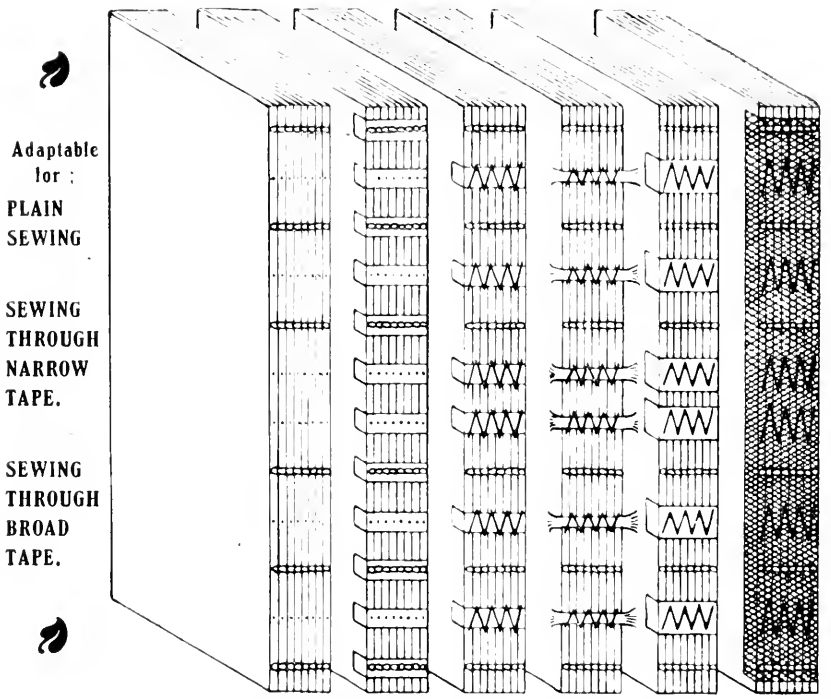

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PREFACE.

A handbook describing the modern methods of commercial Bookbinding and the different machines used in connection with the various processes has long been a desideratum, as none of the works hitherto published on Bookbinding deal at all adequately with this important branch of the industry. It has therefore been thought desirable to present in convenient form the series of articles which appeared in THE BRITISH AND COLONIAL PRINTER AND STATIONER, Vol. LXV., 1909, in the hope that the book will help to fill a lacuna in the literature of Bookbinding and, at the same time, be of service or of interest to those who are concerned, directly or indirectly, with the making of books.

I am indebted to various manufacturers for the loan of the blocks to illustrate their respective machines, and to my friend, Mr. A. J. Macdonald, for preparing, from my rough sketches, the diagrams included herein.

G. A. S.

January, 1910.

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Commercial Bookbinding

A DESCRIPTION OF THE PROCESSES
AND THE VARIOUS MACHINES USED

BY

GEO. A. STEPHEN

Chief Assistant Librarian, St. Pancras Public Libraries
Member of the Book Production Committee of the Library Association

With 70 Illustrations and Diagrams

LONDON
W. John Stonhill and Co.
1910

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Commercial Bookbinding

AS modern writers refer to the different epochs of the world's history as the stone age, the bronze age, the iron age, and so forth, so future writers will refer to the present epoch as the age of machinery. In every department of manufacture there are ingenious machines that minimise hand-labour and greatly accelerate production; consequently innumerable articles are marvellously cheap and within the range of the poor man's exchequer. In the book world scarcely a day passes without there being introduced some new and useful appliance appertaining to one or other of the numerous branches of book production. Compulsory education has created in the masses a rapacious desire for literature, and to-day a veritable cataract of books pours from the printing press at such an enormous rate that the magnitude of the output is conveniently expressed by the words of the Preacher: "Of making many books there is no end." In conformity with this rapid multiplication of books the methods of commercial bookbinding have been completely revolutionised, and there are now machines that have been brought to such a high state of perfection as to perform effectively almost every process in the binding of a book. In a modern bindery there are to be found cleverly constructed machines for folding, bundling, gathering, sewing, smashing, cutting, rounding and backing, and casing-in, as well as equally skilful and useful machines for cutting the boards and cloth, for case-making and for other important operations. In fact, there is scarcely another department of manufacture in which machinery is so completely adapted to meet effectively the requirements for all processes.

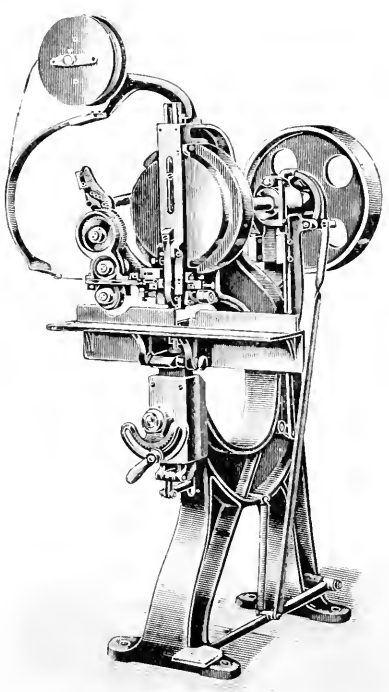

Fig. 1.

PAMPHLETS, ETC.

For fastening together the leaves of pamphlets, trade catalogues, and small work in general, a number of wire-stitching and thread-stitching machines have been invented to stitch such work in different ways. Before proceeding, it may be apposite to refer briefly to the nomenclature used by binders to describe the different methods of fastening the leaves of a pamphlet or book. The term "stitching" refers to the simple method of fastening single sections through the centre of the fold; "stabbing," as the word implies, refers to the process of fastening one or more sections by passing thread or wire through the side of the section or sections; and the term "sewing" is applied to the process of binding together several sections. The term "pamphlet" is somewhat vague and arbitrary, but for the present purpose a pamphlet will be regarded as a small book made up of one or a few sections.

Wire-Stitching.

For pamphlet work wire is generally preferred by binders on account of the economic advantages to be derived from its use. There are on the market a great

variety of wire-stitching machines for stitching single sections through the fold, or for binding together several sections by stabbing them through the left-hand side. Some of these machines are worked by hand or treadle power, others are worked by steam power; a few of the machines are worked with ready-made staples, but most of them take the wire direct from the reel or spool, which revolves on a spindle fixed to the machine, and make their own staples, thereby effecting a considerable saving in wire. These latter machines cut, drive, and clinch the staple at one operation, and usually staples of several different sizes may be made by the same machine.

If the pamphlet consist of one section it may be stitched through the centre of the fold and the staple clinched on the inside or outside as may be preferred, and for these purposes most of the higher priced wire-stitching machines are provided with a saddle and a trough. The most general method of securing pamphlets of single sections is to clamp two or three staples through the wrapper and the centre of the section, clinching the staples inside the fold. If the pamphlets are intended for permanent preservation in their original form, the better way is to clinch the staples on the outside of the section and then to paste the cover to the back of the fold; this method entails more work, with its concomitant of additional expense, but it has the advantage of preventing injury to the fingers of persons who may handle the pamphlets carelessly when reading them. If, however, the stapling is only intended to be a temporary fastening for a pamphlet, prior to the binding together of several of them, then it is not advisable to paste the cover to the pamphlet, because in "pulling" some part of the cover will remain on it. To bind several sections together with wire, they are first placed evenly together on the iron table of the machine and then two or more staples are forced through the

Fig. 2.

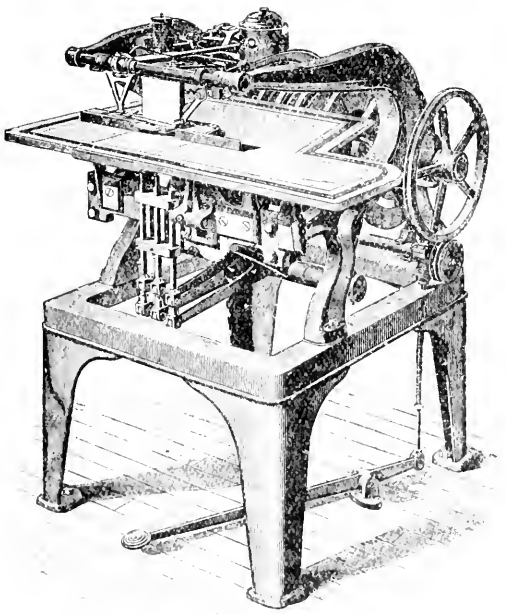

Fig. 3.

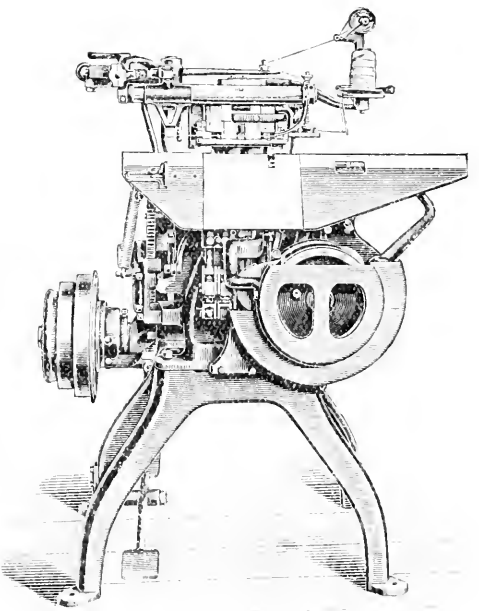

Fig. 4

side of the pile and their ends are clinched at the back. This practice of stabbing is always to be deprecated; the books bound in this manner cannot be opened flat, much less doubled back, and the holes made in the inner margin are very unsightly if the books be afterwards re-bound. The greatest thickness a wire-stitching machine can pierce is $1\frac{5}{8}$ inches, and this extraordinary work is accomplished by a machine (Fig. 1) made by Mr. Aug. Brehmer. Ordinary round iron wire of gauge No. 20 is used on this machine, unless the book is printed on very hard paper, in which case steel wire is necessary. The machine will produce stitches of sixteen different sizes, the sizes graduating by $\frac{5}{32}$-inch, making staples which allow for a proper overlap of the wire at the back for any thickness of work up to the maximum size. Either stitching or stabbing may be done on the table of this machine, and its rate of working is estimated from 60 to 100* stitches per minute. Even wire stitched work is capable of being improved in appearance by inserting the staples at the proper places and clinching them evenly; and it can be rendered less objectionable if care be taken to prevent the staples being clinched too firmly, and thereby crushing the paper.

Thread-Stitching Machines.

For certain classes of work thread-stitching machines are rapidly displacing wire-stitching machines and hand-stitching. There are several ingenious machines which effectively stitch pamphlets through the centre of the fold or through the side; they are fitted with mechanical devices which make the holes, draw the thread through them, tie a tight reef knot, cut the thread, and pick up the end of the thread again for the next pamphlet. These machines are used largely for better-class pamphlet work, exercise books, copy books and work of a similar character in single sections, and they are also used for stabbing two or three sections through the side. A machine-made stitch may be easily recognised as the knot is always tied at one end of the stitch (see Fig. 2), whereas in hand-stitching it is invariably tied in the centre of the stitch.

The Elliott Machines.

The Elliott thread-stitching machines (Fig. 3) (sold by Messrs. Valteis, Jackson and Co.) are estimated to make from 800 to 1,500 stitches per hour and are made in two sizes: the No. 1 machine will stitch work up to a thickness of $\frac{1}{4}$ inch, producing a three-hole stitch three inches long, and it may be fitted with an attachment to make a portion of the stitch in the book and a portion as a loop for hanging purposes; the No. 2 machine will stitch work up to a thickness of $\frac{3}{4}$ inch, making a three-hole stitch four inches long. The Elliott machine is equipped with three hooked needles and a shuttle having a gripping apparatus at one end. After a section has been placed on the saddle of the machine the first needle pierces its way through the fold and by means of the hook draws the thread, which is moved towards the hook by a guide, through the pamphlet; at the same time the needle turns so as to form a loop of thread through which the shuttle is afterwards to pass. The second needle acts similarly, but the position of the hook is reversed. The third needle also pierces the pamphlet, then draws the loose end of the thread through the gripper of arm not through the work and forms a third loop. The shuttle passes through the loops, grips the loose end of the thread of the third loop, and then recedes, drawing the thread through the second and first loops, the latter meanwhile having been formed into two loops by loopers. The shuttle, by returning to its original position, tightens the reef knot thus made, and finally the thread is automatically cut by a knife fixed to the machine.

The Brehmer Machines.

The Brehmer thread-stitching machines (Fig. 4) make stitches of various lengths and may be fitted with an arrangement for looping. One of the Brehmer machines produces one size of stitch only, having a length of two, three, four or five inches. Another machine produces two sizes of stitches, which may be five and four inches, five and three inches, five and two inches, four and three inches, or four and two inches in length. A third machine produces three sizes of stitches, of any of the following lengths, viz., five, four and three inches, five, four and two inches, five, three and two inches, or four, three and two inches. The fourth machine produces four sizes of stitches, viz., five, four, three and two inches. The two inch stitch is a single one having two holes, and the stitches three, four and five inches in length are double stitches having three holes. These machines will stitch work up to $\frac{1}{4}$ inch in thickness and will run up to an estimated speed of 2,400 stitches per hour. The instruments for effecting the stitching and tying the knot consist of three hooked needles, two grippers and a fork-like device. In operating, the pamphlet to be stitched is placed on the saddle of the machine, above which are the upper gripper and the cutting device. The upper gripper draws the thread along above the paper and the first hooked needle pierces the paper from below and draws the thread down through the paper and between the prongs of the fork fixed in a horizontal position; the fork then rotates upon its

* It must be understood that all the figures herein given of the speeds of the various machines described are those stated by the makers of the respective machines; these figures doubtless represent the maximum output of the machines when worked under the best possible conditions, and consequently the actual output that obtains in general practice is less because of necessary stoppages, the ability of the operators, and so forth.

axis so as to wind the thread around it, and thereby forms a loop through which the lower gripper is to pass. In the meantime the second hooked needle has pierced its way through the paper and drawn the thread down, forming a loop. The lower gripper then enters the two loops thus formed and just before the gripper reaches the third hooked needle it opens its jaws, so that the third needle, in its descent after having pierced the paper, can pass the thread through the open jaws. The jaws then close and the gripper moves backwards, carrying the thread through the attachment for making loops. It will stitch work up to ¼-inch in thickness, and its output is estimated at from 1,200 to 1,800 stitches per hour. This machine also has three hooked needles, but the devices for forming the knot are different from those in the Elliott and Brehmer machines and consist of two grippers and a pin. The pamphlet to be stitched is placed on the table of the machine, above the needles, and is held firmly in position by the pressure plate, on which is fixed a thread-cutting device in the form of shears. The correct length of thread is automatically

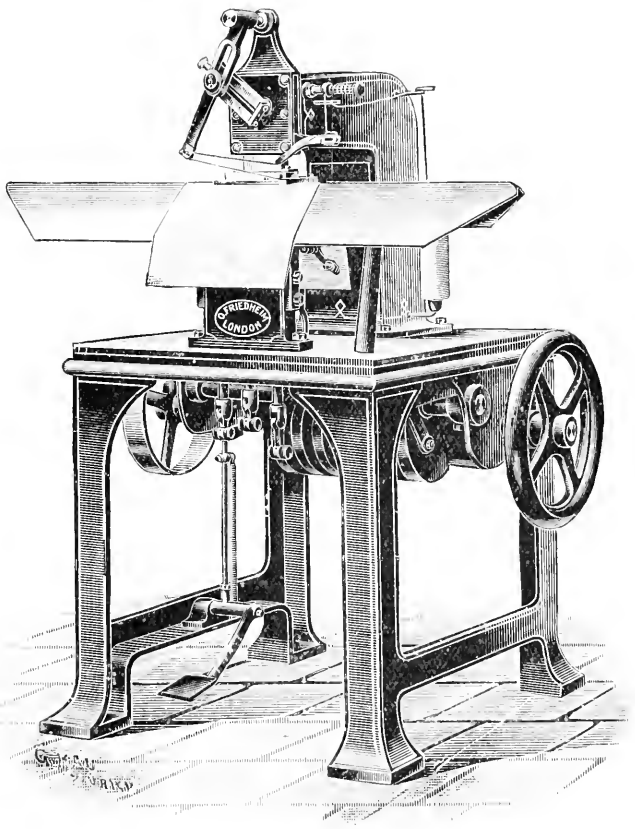

Fig. 5.

two loops, whereupon the tightening of the thread is effected to secure the knot, and the thread is automatically cut off by the cutting knife secured to the upper part of the machine.

The Martini Machine.

The Martini thread-stitching machine (Fig. 5) (sold by Mr. Oscar Friedheim) will produce a single stitch two or three inches in length and a double stitch four or five inches in length; and it may be provided with an drawn from the reel and stretched above the pamphlet. The first hooked needle pierces the paper, catches the thread, and draws it downward through the paper. Meanwhile the second needle has acted in a similar manner; it then makes a quarter-turn, thereby forming a twisted loop which the needle afterwards releases. During this operation the third needle has also pierced through the paper and drawn the remaining portion of the thread down through the paper and between a device

which then grips the thread. During this time the pin and the grippers have formed the first loop into a double loop, and this is kept open in the path of the gripper-needle. The gripper-needle then passes horizontally through this double loop and the second loop, and opens its jaws to catch the end of the thread which is now held taut; thereupon the jaws close and the gripper-needle recedes, drawing the end of the thread through the loops. When this has occurred the knot is drawn tight and the thread cut by the shears.

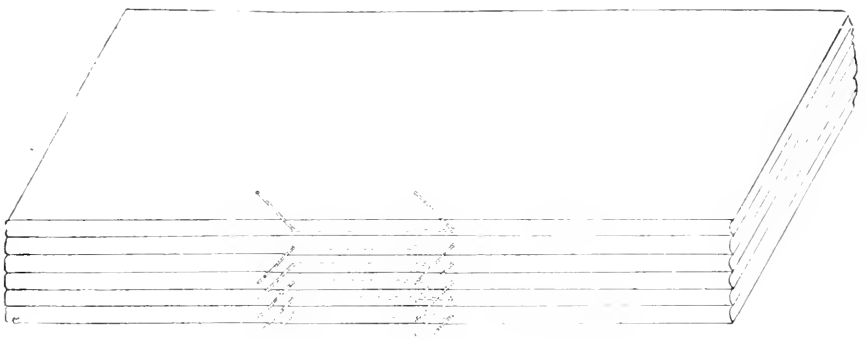

Fig. 6.

Thread-Stitching by Folding Machines.

Another method of securing small books made up of a few sections and having paper covers is in vogue on the Continent, especially in Germany, and the extensiveness of this method of binding testifies to its approval by the trade. Instead of stabbing the sections, pieces of thread are automatically inserted in the sections during the last fold, by an apparatus on the folding machine, so that the ends of the thread project at the back, as in Fig. 6. After the various sections forming the book have been gathered together, their backs are glued over (see Fig. 7) and the paper cover attached, thus fastening the loose ends of the thread to the back of the book. This method is of advantage, practically because the books open quite flat, and economically because no time is occupied in stitching the books. Brehmer's folding machines, if desired, may be provided with single or double thread-stitching apparatus for doing this work. The apparatus is generally arranged with fixed heads to produce stitches each $1\frac{5}{8}$ inches long, having a distance of $3\frac{1}{2}$ inches between them; but, if preferred, the apparatus may be arranged to produce shorter stitches, or the heads may be made adjustable.

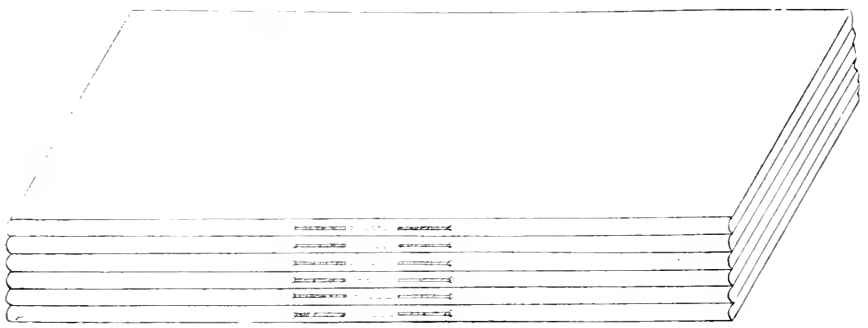

Fig. 7.

The Sheridan Perfect Binder.

A revolution in the method of binding monthly magazines was inaugurated by the invention of the Sheridan "Perfect Binder" (Fig. 8), which is now used for binding the *Strand Magazine* and other publications. This American mechanical contrivance will bind magazines and attach a paper cover without the use of thread or wire. It really accomplishes work similar to that done by hand in

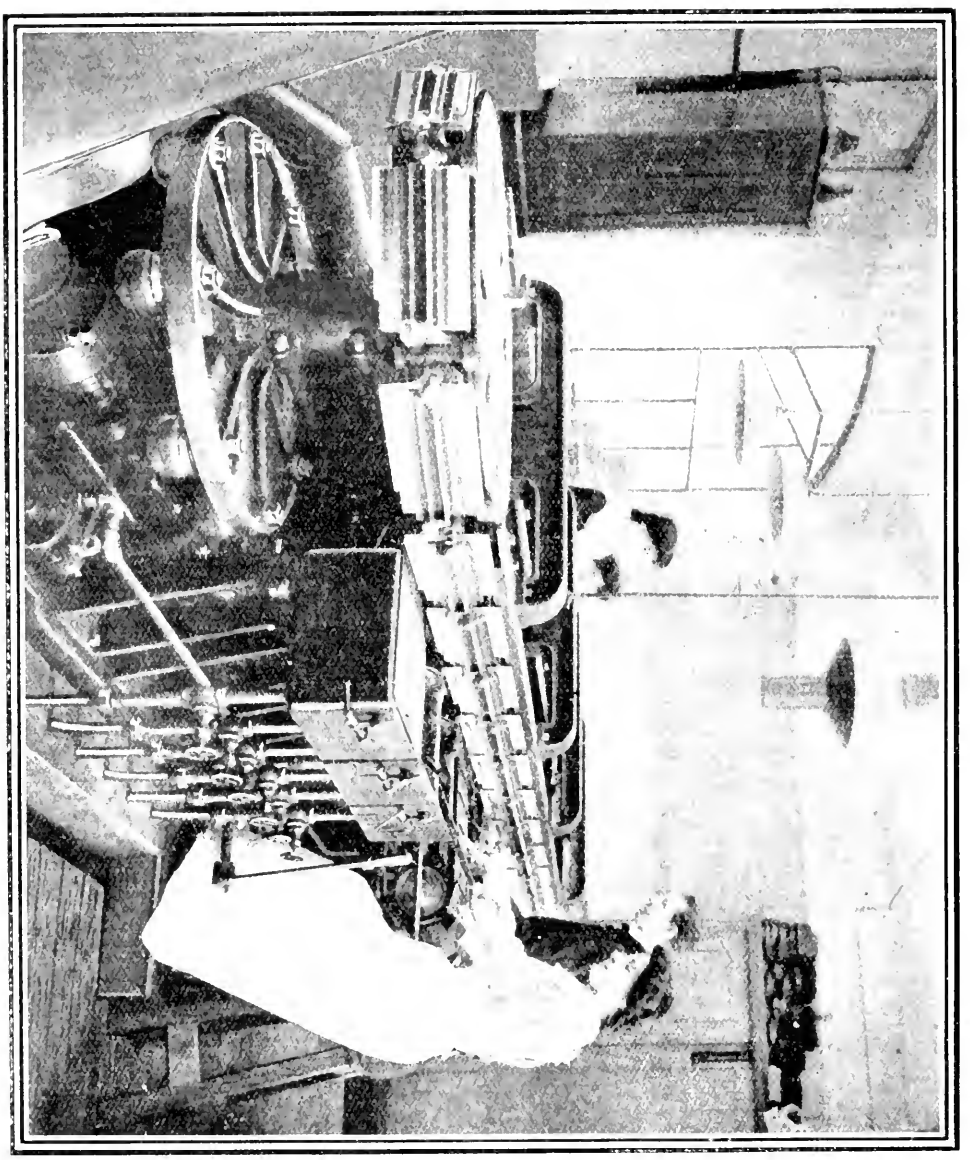

Fig. 8.

binding, with caoutchouc magazines and works consisting almost wholly of plates. This machine, some eighteen feet long, is elliptical in shape, and is manipulated by one man and three girls. Its principal feature is a series of thirty jaws or clamps which travel continuously round the machine in a vertical position. When a pair of jaws approaches the first operator they open automatically and a complete magazine, minus the paper cover, is placed between them, the fore-edges being uppermost. The magazine is gripped tightly by the jaws and conveyed to a knife working horizontally, which cuts off the edge of the folds. The back of the magazine, now consisting of single leaves, passes over a series of small circular saws which roughen the edges to prepare them for receiving the adhesive, and the paper dust is automatically blown into a box. The adhesive is applied by two rollers, revolving in tanks containing a special composite mixture, and the magazine then picks up from a small moving table a piece of mull, previously cut to the exact width of the back, to produce the necessary backing. The pieces of mull are fed on to the table by the second operator. Immediately the mull has been picked up the magazine passes over a pile of covers conveniently arranged and picks up one in passing, a sufficient quantity of the adhesive having penetrated the mull. The man who controls the machine watches that this operation is done properly. In order to attach the cover securely to the magazine, its back is punched and pinched three times by part of the mechanism of the machine before the magazine is finally delivered upon a table, from which it is removed by a girl and placed on a pile. The magazines are allowed to stand for several hours before being trimmed in order that the backs may become set. The machine is estimated to work up to the high rate of 2,000 magazines per hour, but the actual output varies, of course, according to the class of work done, and the conditions obtaining. The machine at Messrs. Newnes's premises, when seen by the writer, was turning out the *Strand Magazine* at the rate of about 1,200 per hour.

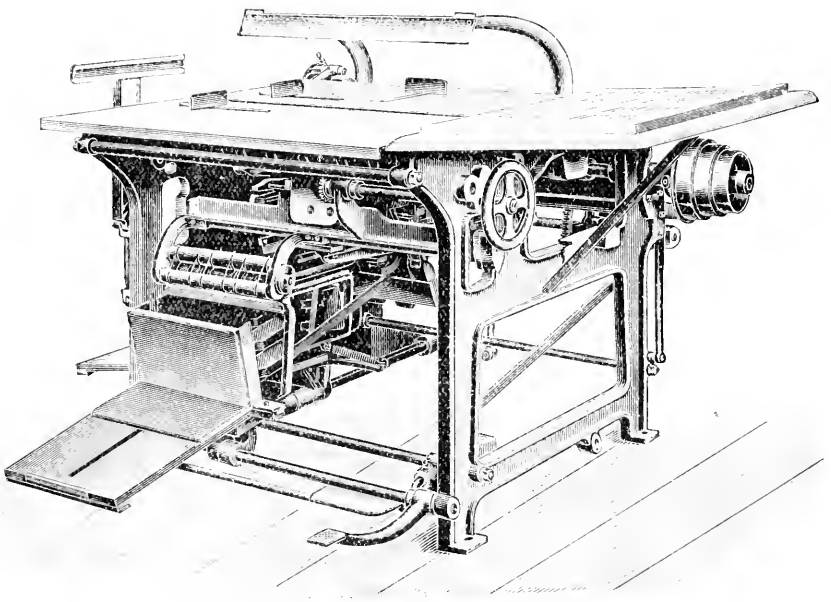

Fig. 9.

EDITION BINDING.

In the following account of modern methods of edition binding the object of the writer has been to describe typical machines constructed for all the different processes, although, for various reasons, one or two of the processes, such as folding and gathering, continue to be done by hand in most binderies.

Folding.

The first operation in edition binding is folding, and whether it be done by hand or by machine, great care must be taken to ensure that the margins are equal and that the headlines are perfectly even throughout the book. This process is done by hand if the quantity of sheets be comparatively small, or if the nature of the work

necessitate it. For ordinary book-work, however, folding machines are used in some up-to-date binderies in this country and they are more generally used in America. Machine work necessitates the folding of the first sheet of the whole edition before proceeding with the second sheet, and is therefore sometimes disadvantageous because the subsequent operations cannot be commenced until the whole edition is folded. There are numerous folding machines on the market, constructed to make various folds and having different devices for securing correct register of the pages; some of the machines are adapted for hand-feeding, others have an automatic feeder attached to them. There are machines for folding a sheet once, making four pages; twice, making eight pages; three times, making 16 pages; and four times, making 32 pages; besides these, other unusual folds, such as for 24 and 48 pages, may be made. Quadruple 16's and double 32's are now made, and some of them will insert one sheet within another before delivering them. For ordinary book-work the sheets are usually folded three times to produce a folded section* of 16 pages. Broadly speaking, correct register is obtained by feeding the sheets on to the machine according to guides, or to "points" or small slits. Many of the folding machines are equipped with devices for guiding and pointing. Feeding to points is done by hand and there are two methods: one method necessitates the sheets being perforated with tiny holes—done in the process of printing—so that the sheets may be placed over needle-points on the feeding board of the folding machine before the folding-blade descends; in the second method, the sheets are placed on the bed of the machine and, before the folding-blade descends, the operator adjusts each sheet by the aid of steel points carried on an arm which rises and falls at proper intervals to allow the sheets to be placed beneath the points.

The principle on which the folding of the sheets is effected by nearly all the folding machines is very similar: a dull blade descends on the sheet at the part where the fold is to be made and presses it between two rotating rollers which draw it in, thereby making one fold. The sheet is then carried automatically on travelling tapes to another pair of rollers and folded again in the same way, and this process is repeated until the desired number of folds has been made, when the folded section is delivered into a trough. When sheets of paper are folded transversely to previous folds, puckering or creasing of the paper inside the folds takes place; this is because the innermost bend being least and the outermost bend being greatest in extent, the layers cannot slide over each other, owing to the folded layers being connected at the heads of the successive transverse folds. To obviate this creasing or puckering most of the recent folding machines have devices for perforating or cutting the sheet at certain places during the folding operation.

The best-known folding machines are made by the Dexter Co. of New York (whose London agents are Messrs. T. W. and C. B. Sheridan Co.), Chambers Brothers Co. of Philadelphia, the Brown Folding Machine Co., of Erie, Pennsylvania, Mr. Aug. Brehmer, The Cundall Folding Machine Co., Preusse and Co., of Leipzig, Mr. Oscar Friedheim, and the E. C. Fuller Co. of New York. An illustration (Fig. 9) is given of Brehmer's folding machine, size "Ca.," which is arranged to fold sheets from $12\frac{1}{2}$ by $18\frac{1}{2}$ inches to $33\frac{1}{2}$ by 44 inches, producing sections of 4, 8, 16, 24 or 32 pages as desired; Fig. 10 shows the position of the rollers of this machine. The

Fig. 10.

output of the different machines varies very considerably, according to the make of the machine and whether it is fed by hand or automatically; the range is from about 2,000 to 6,000 sheets per hour.

Dexter Machine.

The Dexter Rapid Drop Roll Double 16 Folder (Fig. 11) is designed to fold sheets of 32 pages each, and to deliver them in separate troughs of two sixteen-page sections at an estimated speed of 6,000 sections per hour, or to insert one section within another, forming a section of thirty-two pages. The sheets to be folded are placed on a table at the rear of the machine. An automatic feeding device passes a sheet into the machine and it is carried by travelling tapes to a position above the first pair of folding rollers, where it is adjusted by a mechanical automatic pointing attachment by which the sheet is registered to small slits made at the time of printing, thus securing accurate register independently of the margin. The sheet is then given its first fold by the folding blade pressing it between the rollers, and as it passes between them it is slit into two parts by a serrated cutting disc attached to one of the rollers. The two separate sheets

*The term "section" is here applied to the folded sheet instead of the term "signature"; the latter word, although largely used by manufacturers of bookbinding machinery and others to describe the folded sheet, is more correctly applied to the letter or figure placed at the foot of the first page of each sheet.

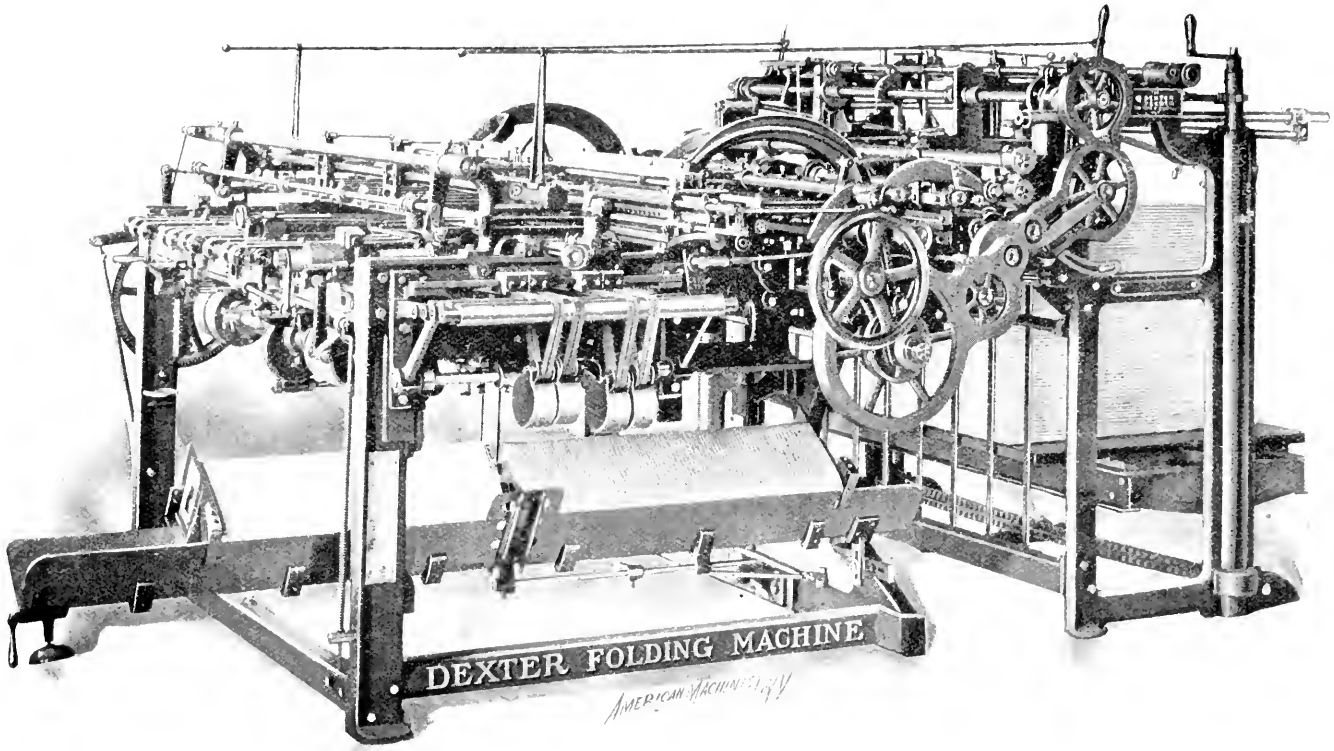

Fig. 11.

are then carried by other travelling tapes into respective positions above two pairs of rollers (set at right angles to the first pair) and, after being adjusted by grippers, they are given their second fold. Each sheet is then conveyed to a position above a pair of third folding rollers (set at right angles to the second folding rollers and of course parallel to the first pair) and adjusted by grippers; these rollers impart the final folding and deliver the two folded

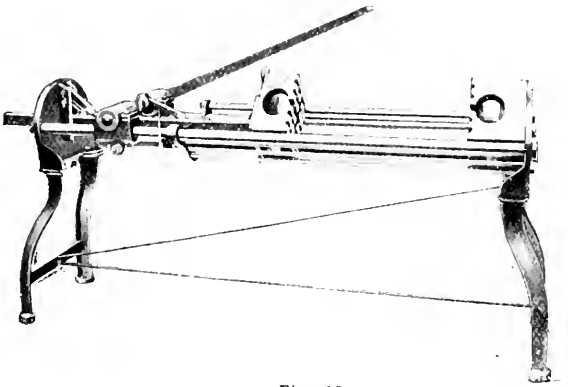

Fig. 12.

sections of 16 pages each to two pairs of rollers from which the sections drop into separate delivery troughs. Perforators may be fixed near the second and third fold rollers so that the sections may be partly cut open at the heads to prevent creasing or buckling.

If it be desired to turn out one 32-page section instead of two 16's, the third fold blade is thrown out of use on one side of the machine and accelerated speed is given to the sheet that otherwise would be folded by this blade as it passes on top of the other sheet, both of them having had two folds. Then the third fold knife on the one side of the machine comes down and folds the two sheets accurately together and they are delivered in one hopper. As soon as the insertion has been made the 32-page section is deposited into one of the troughs.

Bundling.

It is not always convenient to commence the binding of an edition of a book as soon as all the sheets have been folded, and for safety, especially in large binderies, it is necessary to tie up the different sections separately in bundles. For this purpose bundling, or signature presses, have been constructed, by which bundles of equal size can be tied up neatly under enormous pressure with a board at the top and bottom of each bundle, and then stored in the least possible space. In America the advantage of these useful appliances is greatly appreciated and they are to be found in all well-equipped binderies, but in this country they seem to be conspicuous by their absence, except in a few binderies. The "Crawley" and "Hercules" signature presses, and those made by Mr. Oscar Friedheim, Mr. Karl Krause, and Messrs. J. Greig and Sons are all well-known. The Crawley Bundling Press (Fig. 12) (sold in Great Britain by the Hobbs Manufacturing Co.), takes sections from 3 by 4 inches up to 9 by 12 inches, and if boards be used against the heads on each side of the bundle sections of larger size can be pressed. Greig's Bundling Press (Fig. 13) has a trough set at an angle of 45 degrees, into which the sections are placed; pressure is applied by a powerful screw until the sections are quite compact, when they may be conveniently and tightly tied round the four sides before the pressure is released. The "Parkside" Bundling Ma-

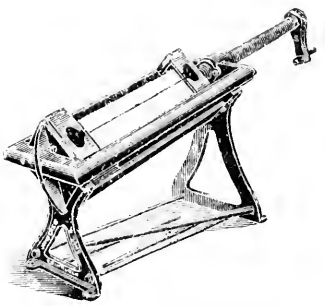

Fig. 13.

chine (Fig. 14) was designed specially to meet the requirements of Messrs. Thos. Nelson and Sons' Factory at Edinburgh, but it has now been placed on the market. It is principally constructed of rolled steel, and power is obtained by a patented application of an inverted epicyclic train of

hardened steel gears. After the sections have been placed in the machine a quarter-turn of the clutch handle brings the epicyclic gear into action and the platen is driven forward by a simple rotation of the hand lever, thereby putting great pressure on the sections. When the bundle has been tied the clutch lever is given a quarter-turn back to disconnect the gearing completely, and the platen can then be immediately slid back. The machine is made in two sizes: the No. 1 size takes sections up to 9 by 6 inches, and the No. 2 size takes sections up to 11 by 9 inches.

End-Papering.

Prior to gathering, all the plates and maps are tipped (*i.e.*, pasted) to their respective sections, and the end papers are attached to the first and last sections of the books; in the subsequent operation of casing-in one half of each end-paper is pasted to the inside of the adjacent board, while the other half constitutes one of the fly-leaves.

Lewis Machine.

An American machine, the Lewis End-papering machine (Fig. 16) (sold by the E. C. Fuller Co., New York), is designed to cut, fold, and tip on end-papers to the first and last sections of a book concurrently, and therefore the working parts of the machine are duplicated. On the top of the machine

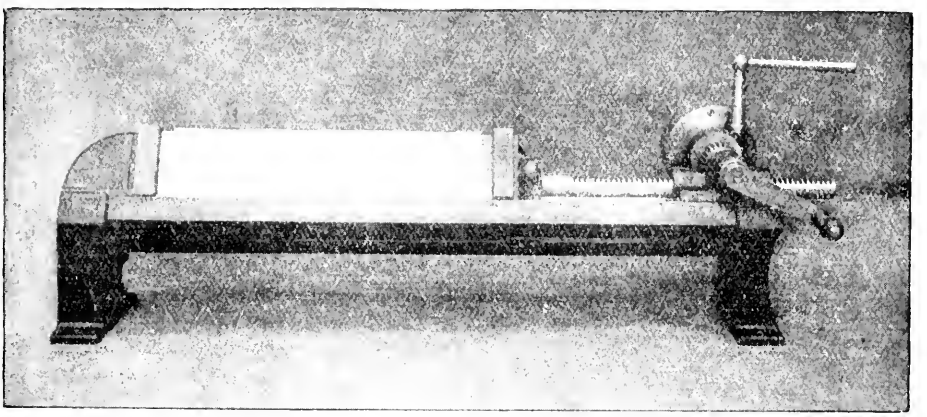

Fig. 14.

Brehmer Machine.

The Brehmer End-sheet Pasting machine (Fig. 15), which was placed on the market at the end of 1907, accomplishes this work at an estimated speed of about 1,800 to 2,700 sections per hour. This machine is also intended for pasting to sections plates and maps of any size. The end-papers and section to be connected together are laid on two flaps respectively; these flaps fold towards each other, bringing the two sections into contact with a pair of vertical rollers which seize and carry them forward. A partition provided with a tongue, extending beyond the rollers, is fixed in line with their meeting faces in order to separate the lower parts of the end-paper and section which are not gripped by the rollers; one section is brought into contact with a wheel, revolving in a tank of cold liquid glue, which, being mounted obliquely, applies a strip of glue reaching not quite to the edge of the section, while the other section is guided past the said wheel without touching it. The two sections are then pressed together at the part provided with adhesive, by passing automatically between another pair of rollers, and are finally delivered flat, by means of two more rollers, on to an automatically descending table; to give the combined sections an inclination towards the table there is behind the last rollers an upright plate with a wedge fastened to it, against which wedge the head of the emerging section strikes.

There are two hoppers in which are placed piles of the first and last sections respectively. It will be convenient to describe only one set of the working parts of the machine. Each hopper is provided with feeding mechanism; the bottom section is separated from the pile by means of a suction cup, and a pair of nippers transfers it to the place where it is to be united to the end-papers. The nippers then release the section and it falls upon the upper surface of an inclined table consisting of endless tapes which cause the folded edge of the section to come up against stop pins. A line of paste is now applied to the lower face of the section at the folded edge by a dabbing strip, which is supplied with paste by descending at proper intervals until it comes into contact with the surface of a roller revolving in a trough of paste. While

these operations are taking place the end-papers are being prepared for attachment to the section. At the rear of the machine are two rolls of paper for making the end-papers. The paper is led over a folding device that folds it through the centre. It is then passed through and under cutting devices which cut it into proper lengths. The feeding and cutting devices are adjustable to the lengths required. By means of feed tapes the end-paper is carried forward until it is advanced upon a small table immediately beneath the section. The section and end-paper are registered by an automatic device and the pasted portion of the section is brought into contact with the corresponding marginal portion of the end-paper. The folded edges of these are then pressed tightly together and passed out through the machine in an endless stream on carrier belts. This process of making end-papers is intended for long runs, like school books; for short runs the roll feed and folding apparatus can be disengaged and folded end-papers fed to the machine by hand. The speed of the machine is estimated at about 80 sections per minute.

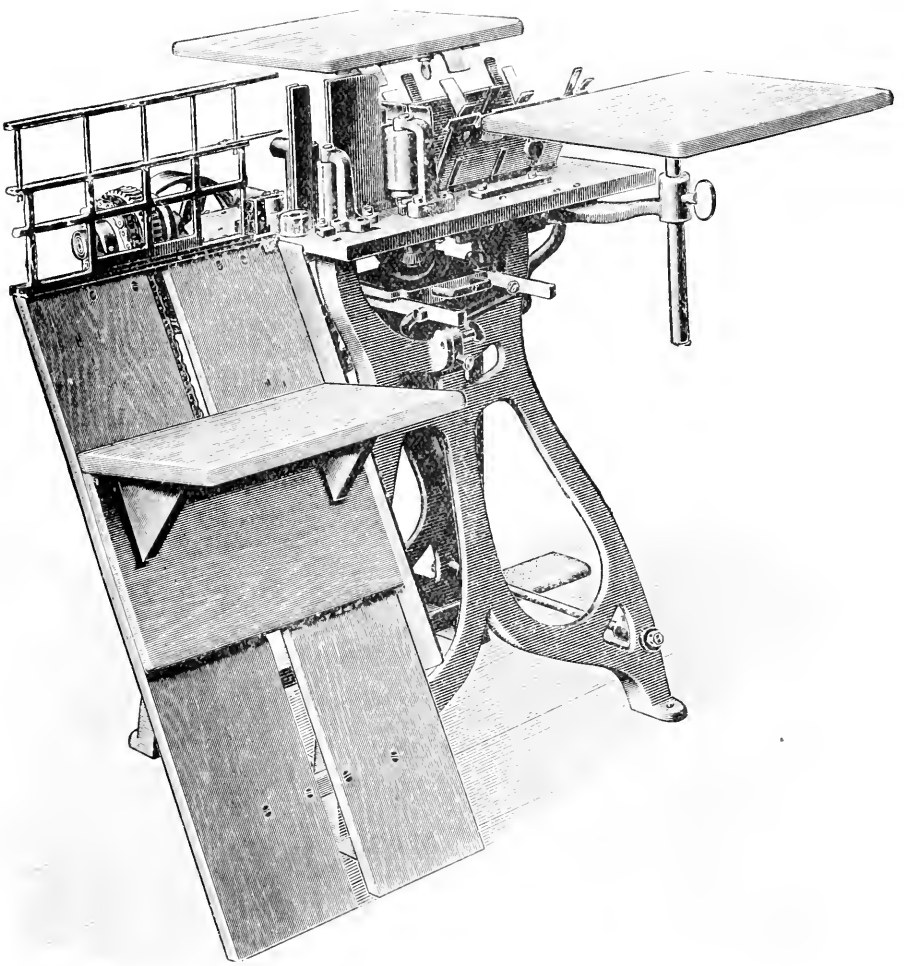

Fig. 15.

Gathering.

After the end-papers have been attached to the first and last sections, the folded sections are ready for "gathering." If this work is to be done by hand, separate piles of the different sections which are to constitute a complete book are arranged in their consecutive order upon tables; these tables are sometimes of a horse-shoe shape and the gatherer walks around the inner side and gathers the book by taking the

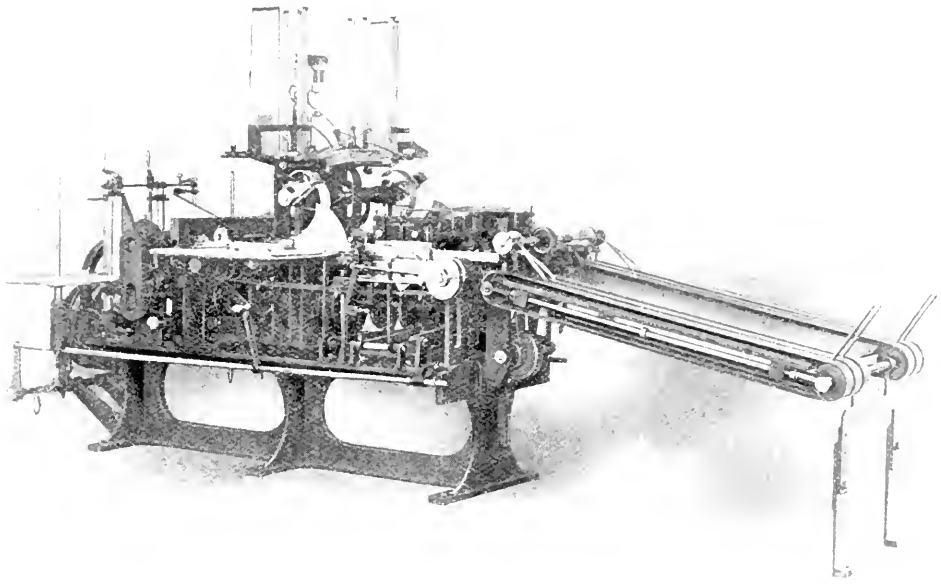

Fig 16.

Fig. 17

top section from each pile, commencing at the pile of the last section. The wearisome work of gathering may now be obviated by using gathering machines, of which there are several on the market. The action of these machines is somewhat similar; the sections are placed in a series of boxes or hoppers and they are delivered automatically on to an endless band which travels in front of the boxes. In America these gathering machines seem to be commonly used for book-work, but in this country most binders prefer to have the work of gathering done by female labour, and the machines are used chiefly for magazine work.

Mercer Gathering Machine.

The Mercer Gathering machine (Fig. 17) (sold by Messrs. T. W. and C. B. Sheridan Co.) may be described in detail. It has a series of boxes arranged in a row on the bed of the machine and in each box is placed a pile of sections, the first box containing a quantity of the last section of the book, the second box containing the section immediately before the last, and so on. Each box is so constructed that, by means of suction apparatus, the under section of each pile is carried to the necessary position where it may be seized by the grippers which work in connection with it. These grippers, consisting of a pair of jaws, move alternately backwards and forwards. As they advance they open shortly before they reach the edge of the section, and on the completion of such movement they close and grasp the section between them. The grippers then retire, carrying the section until it is brought directly over a travelling endless band, moving across the machine from left to right, when the section is released so that it falls upon that part of the band which is at that moment under the grippers. The band has a continuous motion and is speeded to correspond with the speed of the jaws, so that upon the next operation of the machine the different sections on the band are moved forward to the position to receive the section from the next box. By the time the band has travelled across the machine a complete set of sections has been obtained and it is only necessary for them to be removed by an attendant, usually a girl. Should one or more of the grippers fail to operate efficiently, this fact is indicated to the operator of the machine by an electric indicator, which rings a bell and shows on a dial before the operator the number of the box which has missed. The standard size machine may be employed for gathering sections of various sizes from 9 by 11½ inches to 4½ by 5 inches, as the sides and back of each box are adjustable. The machines are built in series of five boxes each and suitable arrangements are provided for coupling two or more series so that any convenient number of sections may be gathered in one pile, but if more than twenty boxes are required the makers advise the installation of two machines. The estimated speed of the machine is 2,100 books per hour.

Juengst Gathering Machine.

The makers of the Juengst Gatherer-Collator claim that their machine detects imperfect sections; that is to say, if a section should have one or more sheets missing, or one or more sheets too many, the machine, by means of a closely set micrometer, would detect the missing sheet, or the section of extra-thickness, and by an arrangement of levers cause the machine to stop. Each lever in connection with a box has an indicating ball on its end and this is caused to rise whenever an error occurs, so that the operator is guided to the seat of the trouble. These machines can be built with any number of boxes. Four operators are required to run a twenty-four box machine: two to feed the sections in the boxes, one to remove the imperfect sections when the machine stops after detecting one, and one to remove the gathered books. It is estimated that 2,500 to 3,000 books per hour can be gathered by this machine. A patent wire stitcher can be attached to this machine to work in unison with it; the conveyor changes the position of the sections from horizontal to vertical and then passes them into the stitcher to be stitched with two or more staples of the well-known form.

The Plimpton Gathering machine and that made by Gullberg and Smith are also well-known in America.

Collating.

After gathering, the books must be collated in order to see that all the sections are in their correct sequence and that none are in duplicate or missing. This is done by holding firmly in the right hand the folded sheets of the gathered book, at the head, while the left hand holds the sheets lightly at the left hand bottom corner; by turning the sheets downward with the right hand they are made to spring upward and fan out, and the left thumb controls them as the collator watches the small figure or letter printed at the foot of the first page of each section.

Sewing.

The next operation is sewing. Sewing is the foundation of bookbinding and is the most essential process upon which the utility of a book depends. Thread and wire are both used in the sewing of books.

Wire-Sewing.

In this country wire is not used to any appreciable extent for the sewing of letterpress books, but in Germany books are commonly sewn with wire. Machines for doing this work are necessarily more complex in construction than wire-stitching machines. A typical wire book-sewing machine (Fig. 18) is that made by Mr. Aug. Breh-

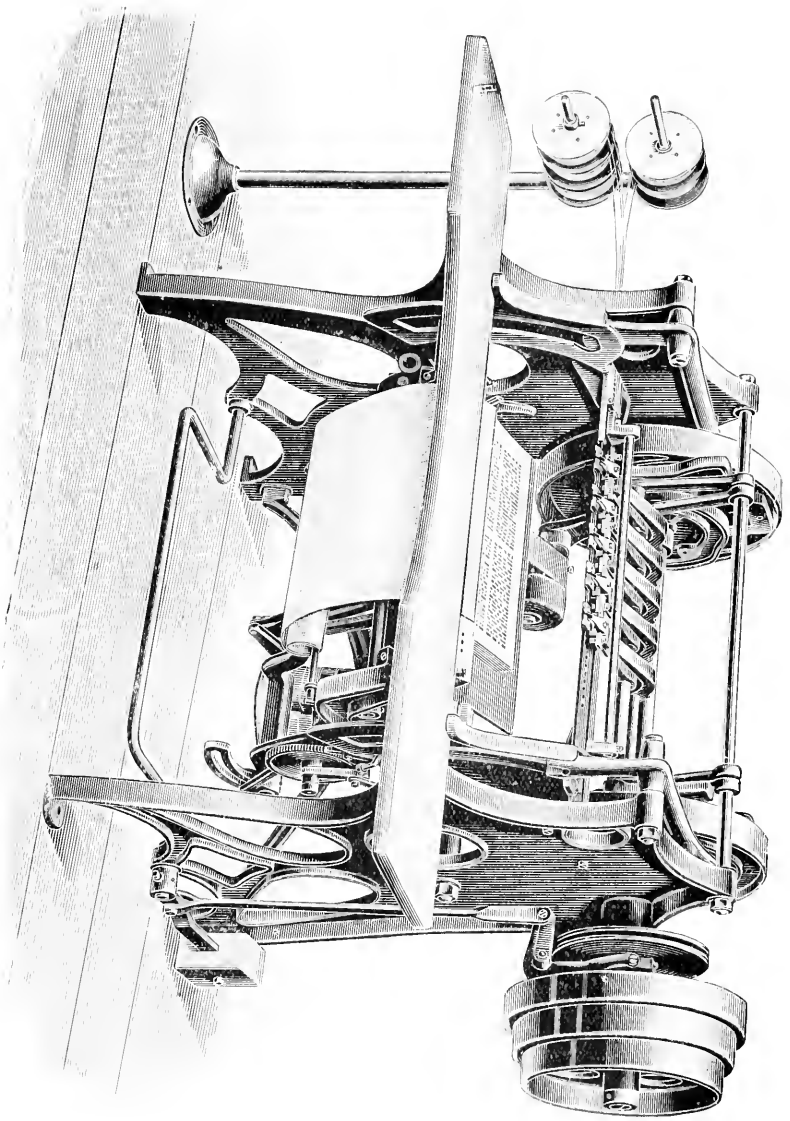

Fig. 18.

mer, which is used for the sewing of many important publications, including Baedeker's Guides and Brockhaus's *Konversations Lexikon*. This machine is equally suitable for letterpress work, guard books, pattern books, post card albums, and similar work. The machine is fed automatically from spools by small steel rollers and at each revolution as many U-shaped staples are produced as are requisite for each section. A section, having been placed on an oscillating table, is brought into position for

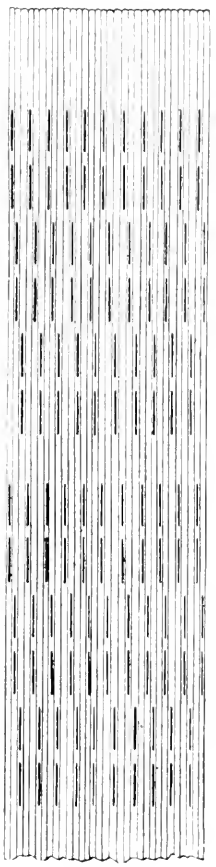

Fig. 19.

being sewn. The staples are driven from the inside of the section through the fold and through the tapes or open fabric which is stretched and firmly held by clasps directly opposite to each staple binder and inserter. The projecting legs of the staples are clinched over, thus producing a firm connection between the section and the tapes or fabric, whichever is used. In order to reduce the swell in the back of the book which would be caused if the staples in the various sections were all inserted in a corresponding position, the machine is so constructed that each staple-forming apparatus has two or three shifts whereby the staples in adjoining sections are inserted in different positions, so that there appear on the back two or three times as many rows of staples as there are staples in each section. Fig. 19 illustrates the positions of the staples in a book that was sewn when the machine was arranged for three shifts; for the sake of clearness the backing material has been omitted from the illustration. It is estimated that about 2,000 sections per hour can be sewn on this machine. There is no doubt that this method of sewing is very strong; indeed, so firmly are the sections held together that usually the books thus sewn have not that degree of pliability possessed by books sewn with thread. Another objection to wire-sewn books concerns the binder: when it is necessary to rebind such books, the girls in "pulling" them are exposed to the danger of having their fingers torn by the staples. The greatest objection, however, to wire-sewn books lies in the fact that sooner or later the wire will rust and rot the paper and the back fabric to which it is secured, so that the book will fall to pieces and cannot be rebound without first repairing every fold an expensive method which would only be adopted for rare and valuable books, because if the book were in print it would generally be cheaper to procure a new copy than to pay the cost of repairing the sheets. Doubtless if only alumenoid wire were used this latter objection would be removed, but as this wire is expensive, its use is chiefly confined to the sewing of books that are to be sent to the East. The various climatic conditions to which books destined for the East will be subjected necessitate the employment of a non-rusting wire, such as alumenoid.

Thread-Sewing.

Thread book-sewing machines are used almost exclusively for edition work in this country and in America. The first book-sewing machine was invented in 1856 by the late Mr. David M. Smyth, of Hartford, Conn., U.S.A.; since that date the Smyth Manufacturing Co. and other manufacturers have invented other machines embodying various improvements, and there are now several efficient machines on the market adapted for different kinds of work.

Smyth Machines.

The Smyth Book-sewing machines are of two styles: the most rapid style has a four-feed arm and the other has a single-feed arm. Curved needles are used in all the Smyth Book sewing machines and the length of stitch is therefore *invariable*, being determined by the curvature of the needles used.

The four-feed arm style, as its name implies, has four radial arms; these arms

project from a perpendicular rod and permit continuous feeding of sections. As an arm presents itself to the operator she places a section over it accurately by means of a gauge. The arm, by making a quarter-revolution, brings the section under a series of curved needles and the arm is then given an upward movement to adjust the section, so as to ensure that the sewing shall take place exactly in the centre of the fold. To facilitate the

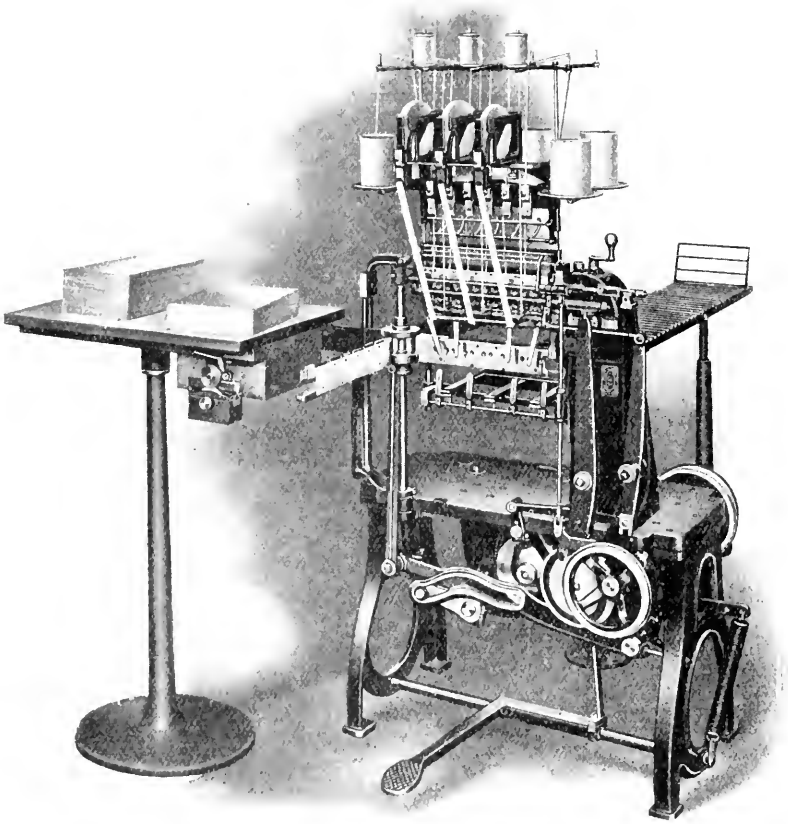

Fig. 20.

movement of the needles, a series of holes is made in the section by punches carried in the arm; this method obviates previous preparation of the section by sawing and it has the advantage of bringing the burr of the paper outside the fold. The needles carrying the threads pass into the section at some of the holes thus made and come out again at others. At the holes of egress is a series of loopers which hold open the loops from the previous stitches in order to allow the needles to pass through them. The loopers then withdraw, leaving their loops around the needles and then come forward taking new loops from them. The needles then recede, leaving these new loops round the loopers, and they occupy their original position in readiness for the next section. The first and last sections of each book are tipped with paste by the operator to give additional strength to the sections. The sections after being sewn are automatically pushed back on a hori-

zontal table forming one continuous row of sections. At convenient times the books are separated from each other by the cutting of certain threads; if the books are sewn on tapes or cords it is also necessary to pull the tapes or cords through each book a sufficient distance to allow portions for the slips.

The Improved No. 3 Smyth Book-sewing machine (Fig. 20) is equipped with six needles for making stitches nearly 1 inch

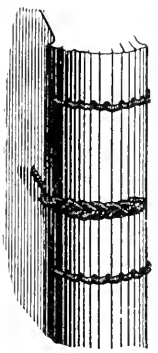

Fig. 21.

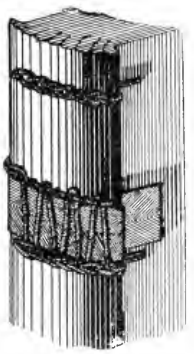

Fig. 22.

n length, and one or more needles can be used, according to the size of the book to be sewn. This machine is estimated to run at a speed of 55 to 60 sections per minute, and it will sew sections as small as 2 inches long with one stitch, a crown 8vo. ($7\frac{1}{2}$ by 5 inches) with four stitches and three tapes or cords, and a book as large as 12 inches by 9 inches with six stitches and five tapes or cords. The style of sewing is "all along," and the sewing may be plain (or French)—*i.e.*, without tapes or other material at the back through or over tapes, or over sunken cords. Fig. 21 illustrates the plain sewing produced by this machine. Fig. 22 illustrates the same style of sewing done by this machine, with the addition of the braiding thread and tape. The braiding thread is an auxiliary thread which proceeds in a zig-zag direction over the tape and connects the threads of alternate sections on either side of the tape. Fig. 23 shows on a much larger scale two series of stitches connected by the braiding thread which thus holds down the tape.

The No. 7 machine (Fig. 24) is also of the four-radial arm style and resembles the one previously described in its general operation and appearance. It has, however, shorter feed arms, enabling it to run at the high speed of seventy to eighty sections per minute a speed which an operator could not maintain for any length of time. The machine is equipped with three pairs of needles, and either these or two pairs only can be used at one time. The needles are adjustable in relation to each other in order to allow the stitches to be placed in any desired positions in the back of the book. The machine will sew sections from $5\frac{1}{2}$ by 2 inches to $10\frac{1}{2}$ by $7\frac{1}{2}$ inches, and the method of sewing is known as "two sheets on," each pair of threads being interlooped, one thread of each pair going into every other section, and the other thread into the alternate ones. The machine is constructed for plain (or French) sewing, sewing through mull or crash, or over raised or sunken cords, or through tapes. Fig. 25 shows the plain sewing done by this machine; Fig. 26 illustrates similar sewing over raised or sunken cords, and Fig. 27 shows on a larger scale the same kind of sewing. Fig. 28 shows two books sewn through mull as they come from this machine with the sewing thread between them cut but the mull or crash uncut; before the sewing thread had been cut these two books were close together with a fold of mull between them, made by an automatic device.

The single arm style of machine (Fig. 29) in its general operation resembles the four-feed arm style, but differs from it materially in construction, being somewhat heavier and adapted for larger and heavier work, such as heavy ledgers, account books, guard books, etc., although it will also sew the same class of work as

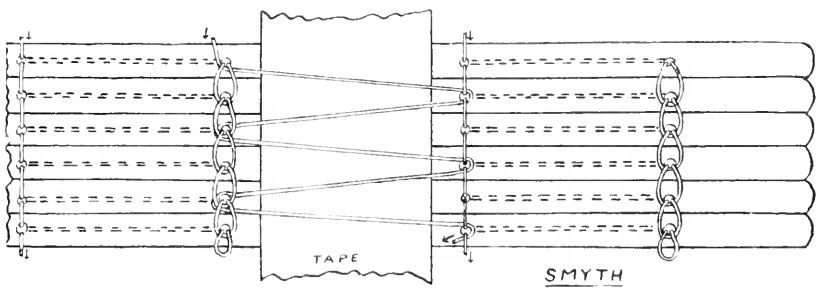

Fig. 23.

that for which the previous machines are designed. It sews on the "all along" principle, and each stitch is slightly less than 1¼ inches long. The needles are adjustable in relation to each other and one or more of them can be used at one time, according to the size of the book to be sewn. This machine will do plain (or French) sewing, sewing over tapes or webbing (single or double), or over raised or sunken cords. The plain sewing produced by this machine is similar to that shown in Fig. 21. Fig. 30 shows similar sewing over tapes, and it will be observed that separate holes have been made in the sections for the braiding thread. Fig. 31 illustrates raised or sunken bandwork as done by the single-feed arm machines. This style of machine is built in three sizes: the No. 4 machine (Fig. 30) has six needles and will sew sections from 2 by 2½ inches up to 14 by 18 inches; the No. 5 machine also has six needles and will sew sections from 2 by 2½ inches up to 16 by 19 inches; and the No. 6 machine is equipped with eight needles, enabling it to sew sections from 2 by 2½ inches up to 19 by 24 inches.

The machines having a single-feed arm are necessarily slower than those of the four-feed arm style, and their output varies considerably, according to the class of work being sewn; the No. 4 machine, of which an illustration is given (Fig. 20), is estimated to run at speeds varying from 30 to 15 sections per minute, but if the work is heavy the speed is naturally reduced.

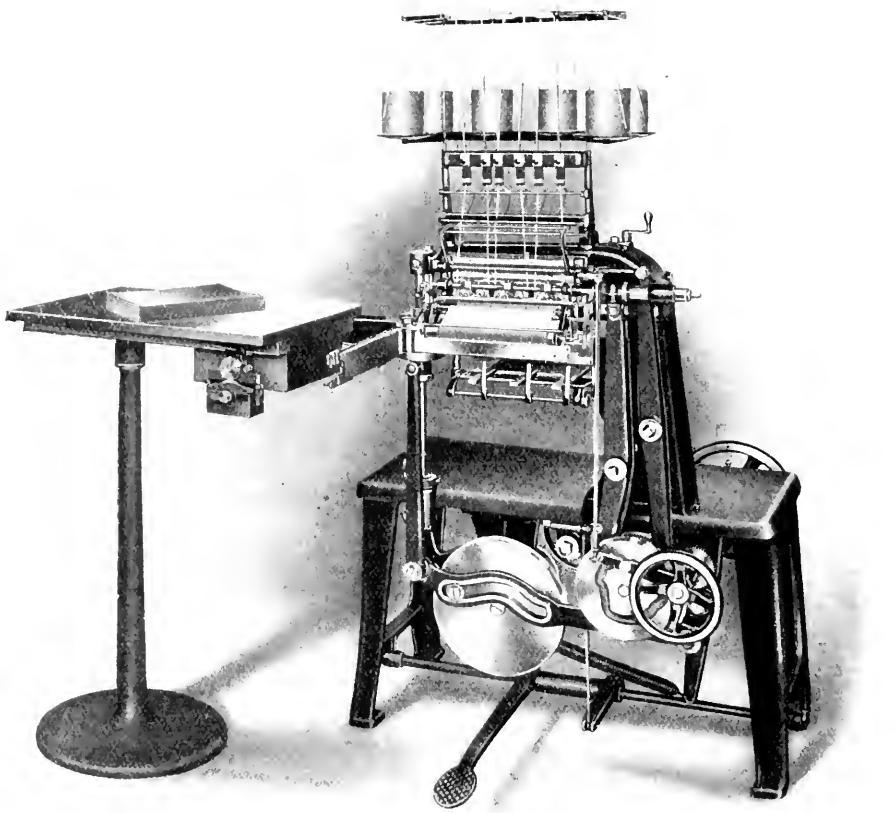

Fig. 24.

Brehmer's Machines.

Brehmer's Book-sewing machines all have single-feed arms. The machine (Fig. 32), first placed by him on the market in 1884, has several essential features peculiar to itself. It sews with single thread "all along" inside the sections; usually three threads are used for sewing a book, the thread from the first section enters the fourth section, the thread from the second enters the fifth, and so on. This machine

cuts the head and tail of each section in order to allow a thread to pass from one section into another, and to prevent the threads being cut by the guillotine when the edges of the book are being trimmed. The section to be sewn is placed by the operator over the feed arm, according to a gauge, and is brought into position under straight needles, each of which carries in its eye a thread supplied by a separate spool. The section is cut at its head and tail by knives and the needles descend through the fold; when the needles reach their lowest limit they recede slightly to form the threads into loops. A shuttle carrying a continuous thread and located in one of the shuttle boxes, which are fixed on either side of the machine, is now directed, by means of a channel in the feed arm, through the loops thus formed (see Fig. 33), and it enters a shuttle box on the other side of the machine. The needles then retire to their original position, drawing the thread delivered by the shuttle tight into the fold of the section. The second and third sections are sewn similarly, receiving their threads from the second and third shuttles respectively. The fourth section receives its thread from the first shuttle on its return journey to its original shuttle box, and at each revolution of the machine one shuttle acts as described until the complete book is sewn. The first and last sections of each book are usually sewn twice to give greater firmness to the book. The machine will sew books on tapes or cords, mull or canvas, or other suitable backing material, which may be run all the way or partly across the back of the book. Fig. 34 illustrates the sewing over tape done by this machine and shows the slits. The threads from the needles may pass over the back of the sections in a straight line, or they may be run in a zig-zag manner in order to obtain a stronger hold upon the material to which the book is sewn.

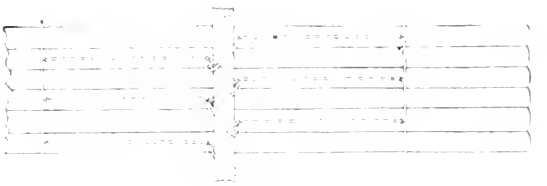

Fig. 27.

This machine meets the requirements of extra thick books, such as Kelly's large Directories and Whitaker's Reference Catalogue, which are sewn by this machine—as it is most desirable that the swell in the back of the book caused by the thread should be reduced to a modicum. This method of sewing is also employed by some binders for edition work, and this is to be deprecated for several reasons. The slits need not be more than ¼-inch before the book is trimmed, but owing to careless operating the slits are nearly always made much larger than is necessary; consequently, when the book is re-bound the kettle-stitches cannot be made as near the head and tail of the book as is desirable. In reading a book, too, it is usually held in the hand and the reader's thumb presses the open section at the tail, causing the slits to become larger.

Brehmer's three other machines are much to be preferred for ordinary book-work. These machines are equipped with straight needles which sew with double thread, and

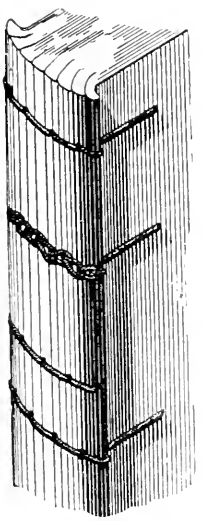

Fig. 25.

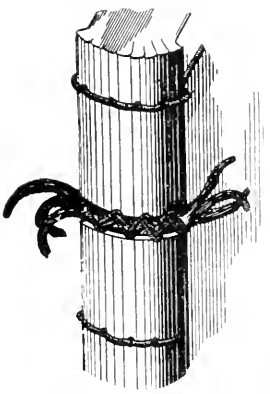

Fig. 26.

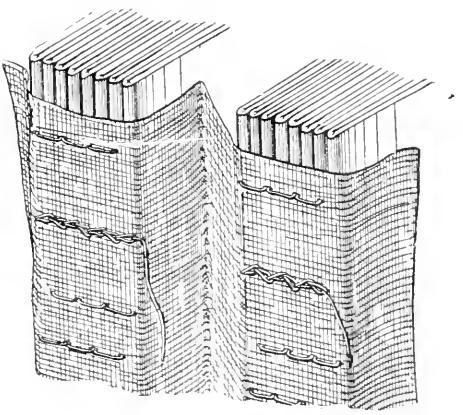

Fig. 28.

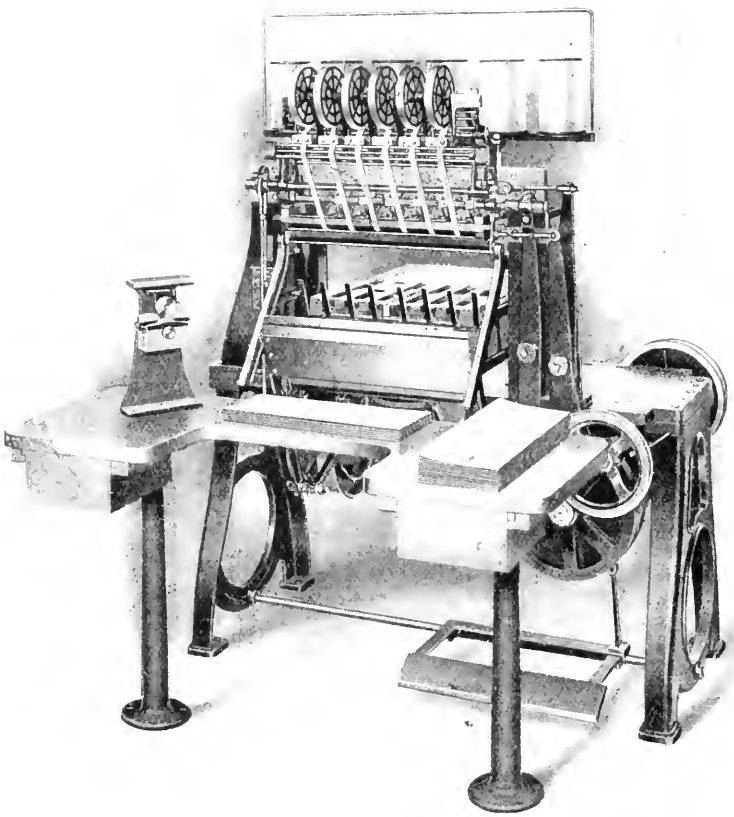

Fig. 29.

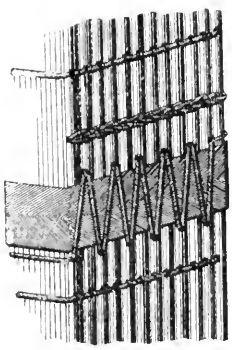

Fig. 30.

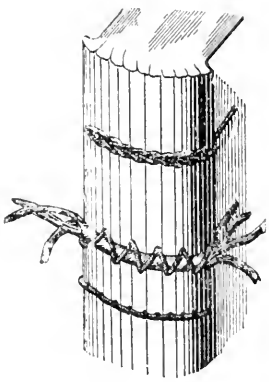

Fig. 31.

no cuts in the heads and tails of the sections are required. The needles are so adapted that the distance between the stitches and also the length of stitch may be varied to suit books of different sizes.

The No. 33 machine (Fig. 35) is specially adapted for account books, ledgers, letter books, and therefore it uses two kinds of needles; stout needles are used for account books and similar heavy work, and thin ones for letterpress work. Its capacity is such that it will sew books of any size up to 18 inches long and the sections may be faced with linen. The sewing may be

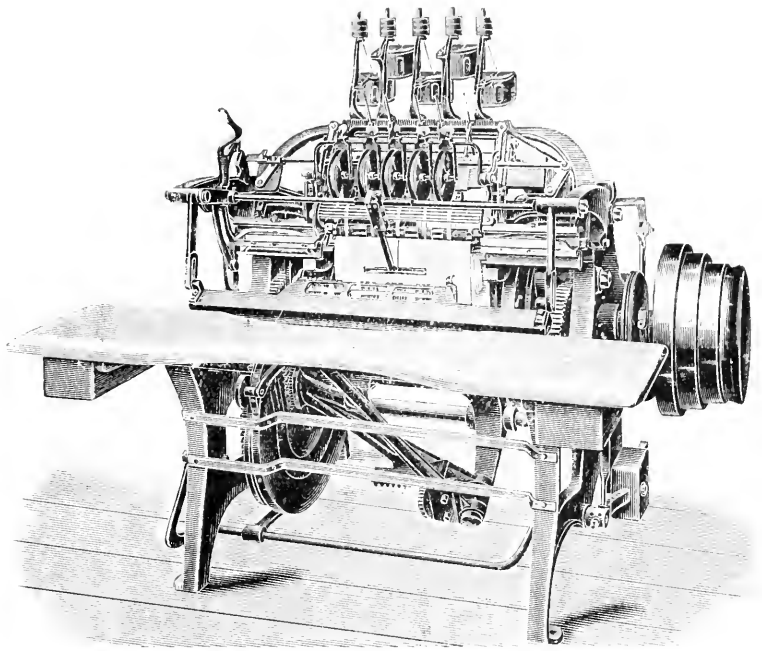

Fig. 32.

copying books and other heavy work, but it will sew books of any size from a ledger 22 inches long to a small pocket book, and it will sew linen-faced sections. It is constructed either for sewing over tapes or through them and the tapes may be of three different widths, viz., $\frac{7}{16}$-inch, $\frac{3}{8}$-inch, or 1-inch. The maximum speed of this machine is estimated at 35 sections per minute. The No. $33\frac{1}{2}$ machine is constructed for sewing account books and letterpress

plain (or French) or through or over tapes. When sewing over tapes, two different widths of them, viz., $\frac{3}{8}$-inch and $\frac{7}{16}$-inch may be used, and when sewing through tapes they may be 1-inch in width. This machine is designed to run up to an estimated speed of 45 sections per minute. Fig. 36 illustrates the sewing over tapes done by this machine. The needles in Brehmer's machines Nos. 33 and $33\frac{1}{2}$ are arranged to make chain

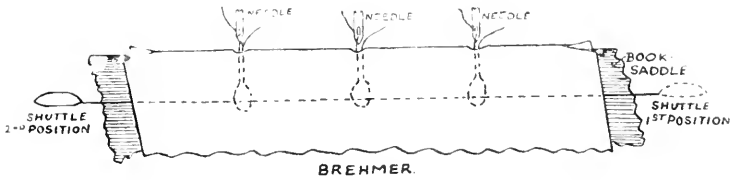

Fig. 33.

stitches at the head and tail of each book.

The No. 38 machine (Fig. 37) is specially designed for letterpress work and the sewing may be plain (or French) or on tape, cord, canvas or mull. Fig. 38 illustrates the sewing over tapes done by this machine when sewing "all along"; the stitches in

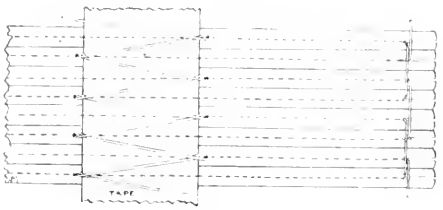

Fig. 34.

the neighbouring sections are of different lengths because of the automatic working of the needles which carry the threads in a zig-zag direction over the tape. The needles in this machine do not make a chain stitch at the tail of the book because the maker is of opinion that, as the machine is primarily designed for books having comparatively thin sections, the chain stitch would cause an objectionable swell in the back of the book at the tail portion. The machine will sew books of any size up to 14 inches long and 9½ inches wide a crown 8vo. may have four tapes and its highest speed is estimated at 50 sections per minute. This type of machine may be supplied to sew on the "two sheets on" principle; Fig. 39 illustrates the plain sewing done by this machine when arranged for sewing "two sheets on."

When sewing on tape, cord, canvas or mull, all the Brehmer machines require wooden blocks to separate one book from the next after sewing, in order to allow slips of sufficient length for each book; the thickness of the blocks of course determines the length of the slips. This method of using blocks secures uniformity in the length of slips and obviates the work of pulling each book along the tapes which are tightly secured to the backs of the books. The books after being sewn pass automatically along a suitable trough at the rear of the machine and are cut apart at convenient times. The operation of the three above-mentioned machines is similar to that of the Martini machines, which are also

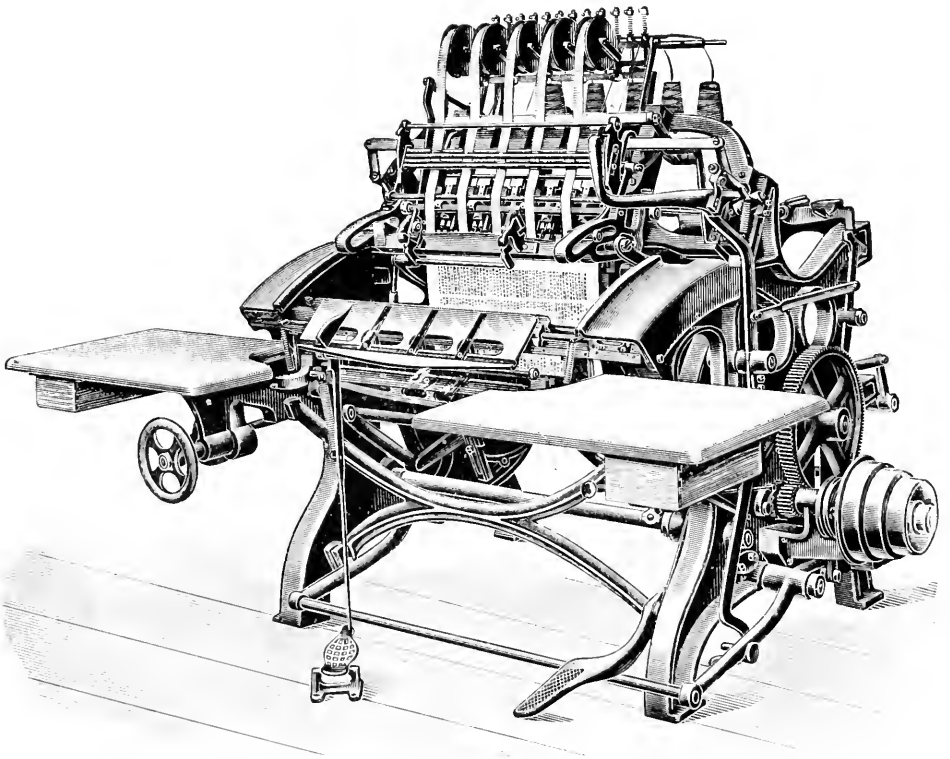

Fig. 35.

of the single-arm type and are equipped with straight needles.

After a section has been correctly placed on the feed-arm, consisting of two steel plates, it is brought up under a series

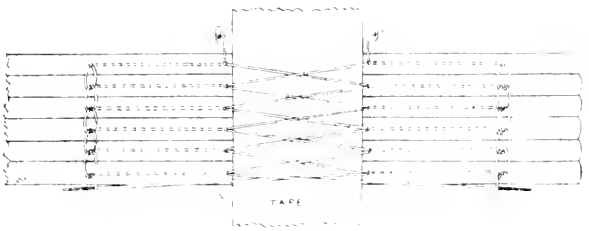

Fig. 36.

of needles and hooks; punches carried in the feed-arm then penetrate the section from within, to facilitate the ingress and egress of the needles and to bring the burr of the paper outside the section. The needles carrying the threads then descend into the section and, withdrawing slightly, form loops which are carried transversely within the section and deposited on the respective hooked needles; these hooked needles carry the loops out of the section and hold them until the next section is sewn. The loops from the succeeding section are carried through the loops of the previous section, which are then released and a chain stitch is thereby made. It is not necessary to tip with paste the first and last sections an obvious advantage when sewing books printed on coated paper because the dropping of a stitch between two books practically locks the thread, and when the backs of the books are glued in the lining-up process it is impossible to unravel the threads.

Martini Machines.

The Martini Book-sewing machine, National No. 1 (Fig. 40), is usually equipped with four stitching heads, but one or two additional heads can be supplied, so that from one to six stitches can be placed in each section, according to its size. The length of the stitch is *invariable*, being $1\frac{1}{2}$ inches long, but the sewing devices are adjustable and the stitches may be brought within $\frac{3}{8}$ inch of each other or placed $1\frac{1}{4}$ or $1\frac{1}{8}$ inches

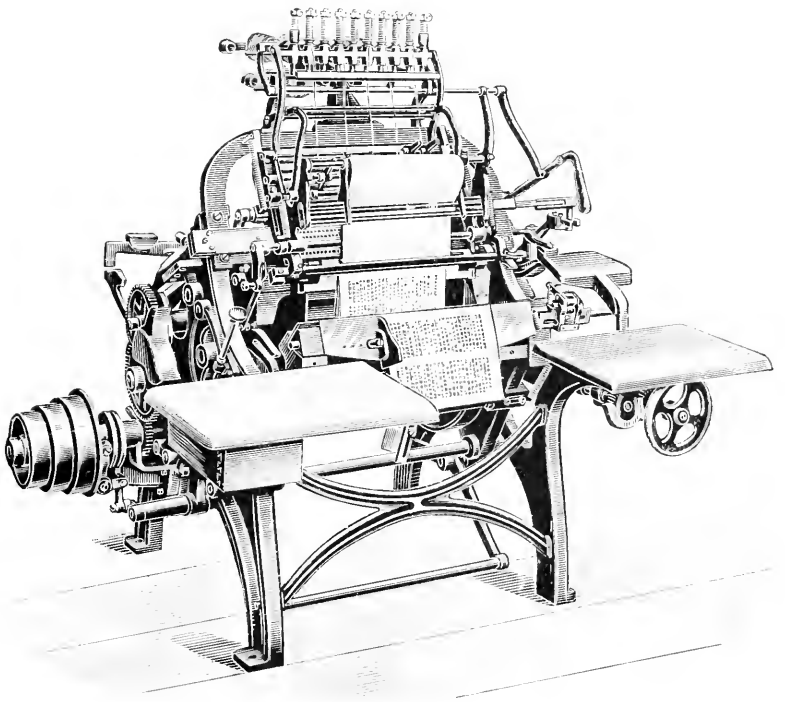

Fig. 37,

apart, to allow the stitches to be placed within the proper distance from the head and tail of each book. The machine has a regulator for adjusting sections that may have been fed unevenly, and fingers which

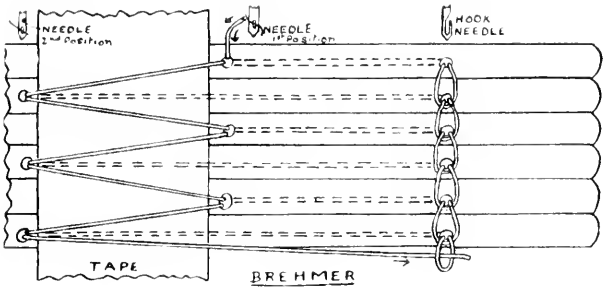

Fig. 38.

hold down the section after it has been sewn; these fingers are provided in connection with the sewing of guards which might otherwise rise up. The machine will sew books from the smallest size up to a maximum of 16 inches long and 11 inches wide, and it is possible to sew in one operation two books up to crown 8vo. size, each having three stitches in the sections. The machine will do plain (or French) sewing, sewing through mull or through tape, or through both if required, and its estimated speed is fifty-five to sixty sections per minute if the sections are fed one at a time; if the sections are fed two at a time by an ambidexterous operator its estimated maximum speed is eighty sections per minute. As each book is sewn the requisite length (which may be varied) of mull or tape is automatically folded down to provide slips. Fig. 41 illustrates the sewing pro-

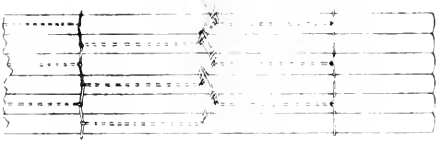

Fig. 39.

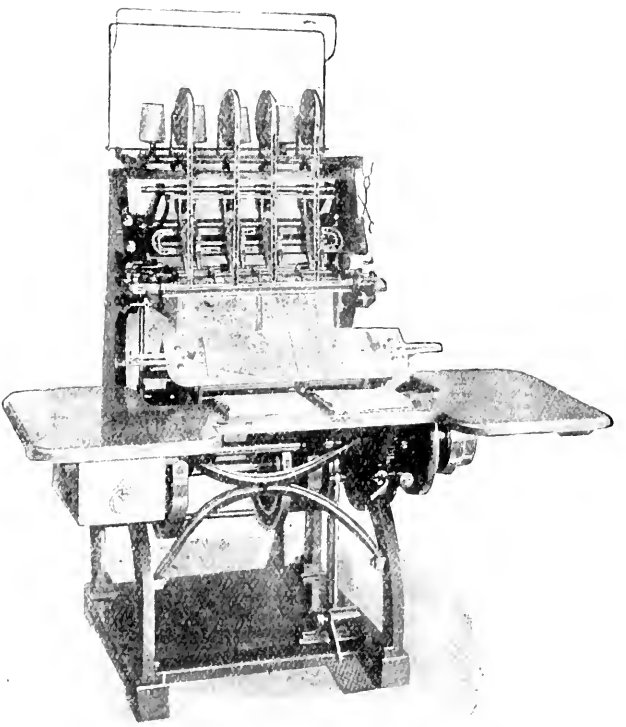

Fig. 40.

duced by this machine when sewing through tape.

The National No. 2 machine is similar in construction to the National No. 1, and besides being adapted for the same kinds of sewing as the No. 1 it will also sew over tape or cord. It is built in three sizes for taking books up to 13½, 18 and 23 inches long respectively. When sewing over tape or cord ziz-zag stitches are made similar to those shown in Fig. 38 which illustrates the sewing over tape done by Brehmer's No. 38 machine; these zig-zag stitches over the material may be of three lengths, viz., ⅛, ¼ or ⅜ of an inch

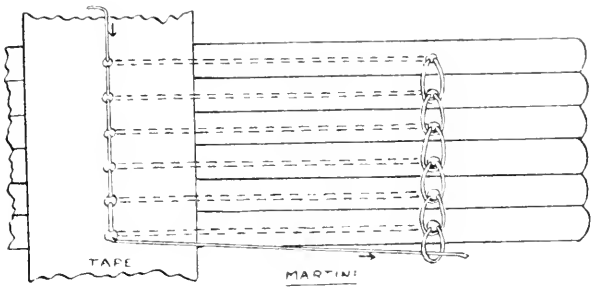

Fig. 41.

When doing plain sewing the stitches may be of four lengths, viz., ⅜ inch, 1 3/16, 1½, or 1¾ inches.

Upon reference to the various diagrams of sewing it will be observed that while

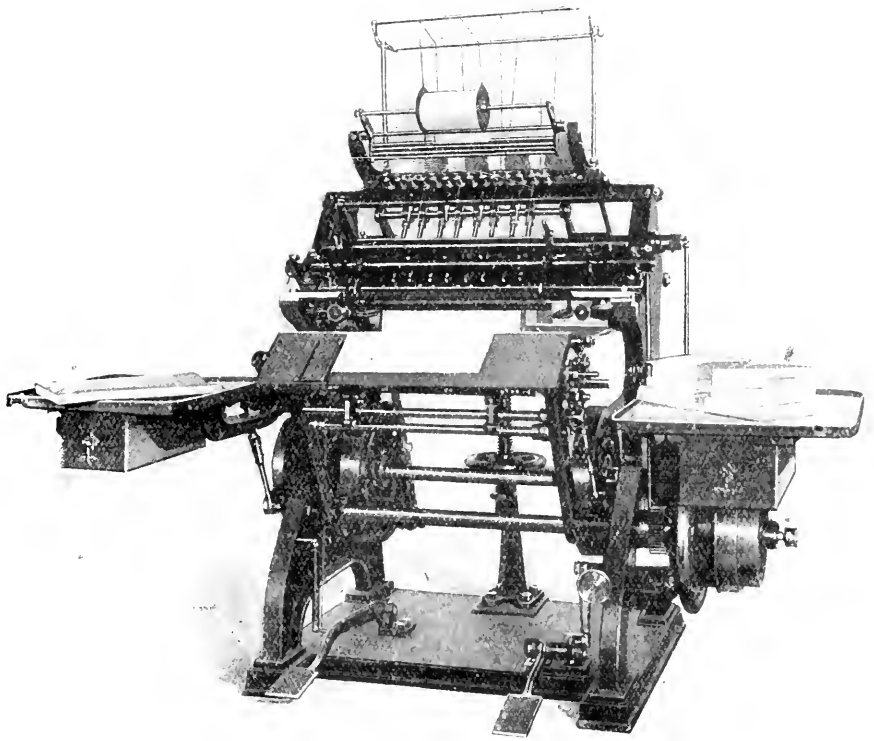

Fig. 42

the thread is formed into a chain at one end of the stitch, at the other end a single thread passes from one section to the next. When sewing on the National No. 1 the chain portion of the stitch is naturally placed towards the head of the book and consequently a single thread goes from one section to the next at the tail. The needles of the National No. 2 are so arranged that a chain stitch may be placed at the head

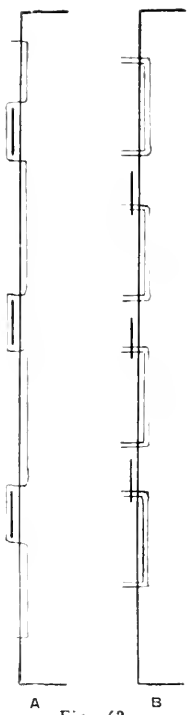

Fig. 43.

and tail of a book. The National No. 2 has an additional improvement consisting of an automatic adjustable saddle, whereby it is possible to feed sections of different thicknesses, without any adjustment on the part of the operator, and to ensure proper tension on the thread.

Edler's Machine.

Edler's Book-sewing machine (Fig. 42) does sewing similar to Brehmer's No. 38 machine, but the needles are so arranged that a chain stitch can be put at the head and tail of a book. The machine is constructed for plain (or French) sewing, or for sewing through or over tape, or through mull. When doing plain sewing the stitches may be $\frac{13}{16}$ inch, $1\frac{1}{4}$ or $1\frac{1}{2}$ inches long; when sewing through or over tape or through mull the stitches are $1\frac{1}{2}$ inches long and the tapes may be either $\frac{1}{4}$ or $\frac{1}{2}$ inch in width.

Machine Sewing v. Hand-Sewing.

By the use of one or other of these book-sewing machines sewing in several different ways may be done; the books may be sewn either "all along" or "two sheets on"; the sewing may be plain (or French), through mull, through or over tapes, through mull and through tapes, or over cords. The output per hour of the different machines varies according to the machine used and the nature of the work, but any of the machines by the above-mentioned manufacturers will sew work equal in quantity to that done by at least five girls. A fair estimate for the average output of a machine is about 1,000 to 1,500 sections per hour, according to the kind of machine used.

The fundamental differences between machine-sewing and hand-sewing are that with one exception (the Brehmer machine that slits the heads and tails of the sections) the machines sew with double thread, and when sewing "all along" as many threads are used as there are to be stitches in each section. An examination of a machine-sewn book will show that each length of thread in a given section is independent of the adjacent length, and that the sections are united by a series of threads passing horizontally along the back of the book; diagram B of Fig. 43 illustrates, in section, machine sewing through tapes

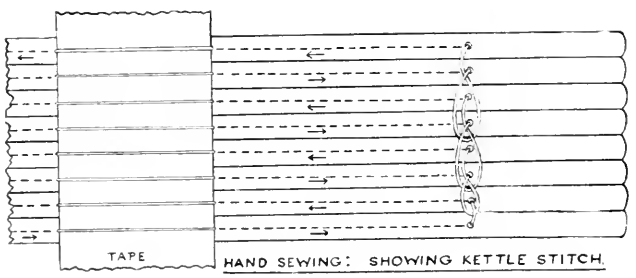

Fig. 44.

when four threads are used. In hand-sewing one continuous thread is used, as shown in diagram A of Fig. 43, the thread going vertically through the whole length

of each section. Each thread in a machine-sewn book is interlooped with itself and embodied in each is a chain stitch, which the makers of the machines wrongly term a "kettle-stitch."

The principle of machine-sewing is a good one because the thread is always held under an even tension, which may be varied to suit the work being sewn, and no section will come out of a book until every stitch in the section has been cut or broken; whereas when sewing by hand the sewer requires considerable experience before she can impart correct and even tension to the thread. Moreover, in a hand-sewn book if the thread is broken, not only will the section come out of the book, but the whole sewing will become loose. The chain stitch, however, is not so strong as the hand-made kettle-stitch, as may be seen by a comparison of Fig. 44 with the other figures showing the chain stitch (Figs. 36, 38, 41), but the chain stitch can be made quite strong enough for the featherweight and other inferior papers which are so largely used at the present time in book production. It will be observed that the chain stitch is formed by the threads of the neighbouring sections passing through one another; the hand-made kettle-stitch, on the other hand, can combine three or more sections at every operation.

Smashing or Pressing.

The book after being sewn is made compact by pressing, although sometimes this operation is done prior to the sewing. In the early days of the craft the books were made as solid as possible by beating them on a stone with a short-handled heavy hammer, a practice mentioned by Clement Barksdale in his *Nympha Libethris; or, the Cotswold Muse*, published in 1651:—

> Has my muse made a fault? Friend I entreat,
> Before you bind her up, you would her beat;
> Though she's not loose or wanton, I can tell,
> Unless you beat her, you'll not bind her well.

This old-fashioned process was superseded by the rolling machine. Both these methods are now obsolete, so far as ordinary edition work is concerned, the swell being taken out of a book by a smashing or nipping machine, which rapidly accomplishes its work in a thorough and effective manner, and facilitates accurate trimming. There are several good smashing machines on the market. Greig's smashing machine (Fig. 45) has two platens: the lower one is stationary but adjustable in order to suit the various thicknesses of books, and the upper one is movable. The smashing is effected by the rising and falling of the upper platen, which brings pressure to bear against the lower one. The upper platen, measuring 22 by 6 inches, opens to a space of about 4½ or 5 inches, and has a rise and fall of 1½ inches when the machine is in action. Usually the whole surface of the books is not smashed or pressed at once; the operator retains his hold on the books, allowing only a portion of the surface to be pressed at one time, and he turns the pile after each squeeze until the books are made thoroughly compact. Two operators can feed in the books to be smashed, one being stationed at either side of the machine, and the capacity of the machine largely depends upon the agility of the operators. The speed of Greig's machine provides for about 25 to 33 nips per minute, and it has been estimated that in a week two men can nip about 50,000 books of the average size of 6½ by 4½ inches by ¾ inch thick. For encyclopædias and other large books Messrs. John Greig and Sons make a larger and heavier size.

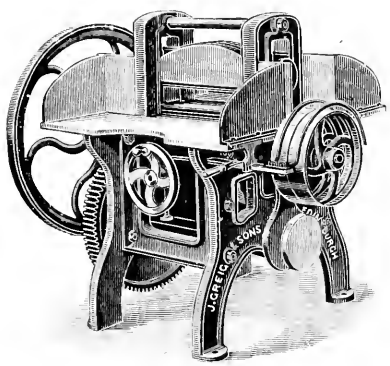

Fig. 45.

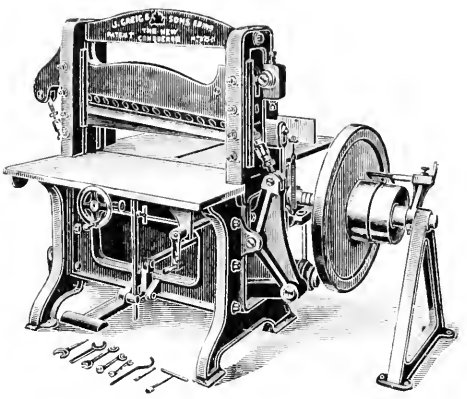

Fig. 46.

Cutting of Edges.

The book is now ready for the treatment of its edges. The question as to whether or not the edges of a book should be cut by the publishers' binder is a moot one. Some persons, probably those in the minority, appear to experience much delight in cutting, with an elegant paper knife, the

edges of a book, and to derive great satisfaction from the knowledge that the pages have not been fingered by any reader with more catholic tastes than they possess; on the other hand, busy readers have a natural antipathy to cutting the leaves of a book when it can be done with mathematical precision by machinery in a fraction of the time that would be spent in hand-cutting. There are valid reasons for and against the practice of issuing books with uncut edges, and the matter should be decided in the light of the future use to which the book is to be put. If the cover which the book is to receive is intended to be a permanent one, then the fastidious taste of the antiquary should be sacrificed to the convenience of the busy reader, and the edges carefully trimmed; but if the cover be regarded merely as a temporary one, then it may be advisable to leave the edges uncut, so that when the book is rebound wide margins may be left. There are, however, additional objections to the latter course: when the edges are cut by hand they become rough and if the reader be careless, jagged also—thereby making it difficult for the reader to turn over the leaves quickly, and books with their edges so cut become veritable dust-traps. At the present time the usual practice is to issue publishers' books with the three edges cut; and occasionally the edges are tinted or the top edge is gilt. Probably the best treatment for the edges of publishers' books is to cut and gild the top and to leave uncut the fore-edge and tail.

The cutting of edges, needless to say, is not performed by a plough but by a cutting machine, of which there is an almost endless variety. Immediately before the books

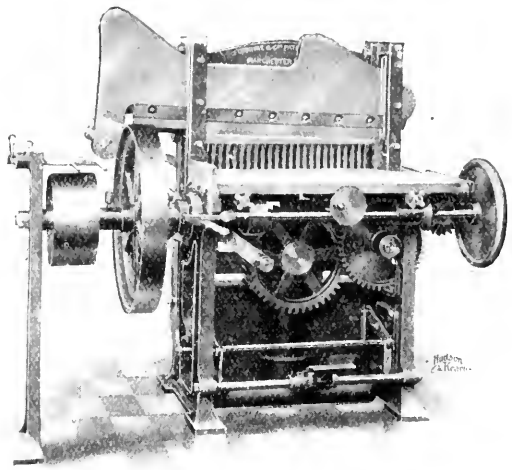

Fig. 47.

are placed on the bed of the cutting machine, it is very essential that the books be knocked up squarely at the back and head, otherwise the books will have a very objectionable appearance when they are cut. Some machines have only one knife, others have two knives, and others have three; some of them are self-clamping, others must be hand-clamped by means of a screw. Most of them, however, work on the same principle: several books are placed on the bed of the machine according to a gauge, the clamp grips them tightly, and a heavy knife descends and rapidly cuts the edges.

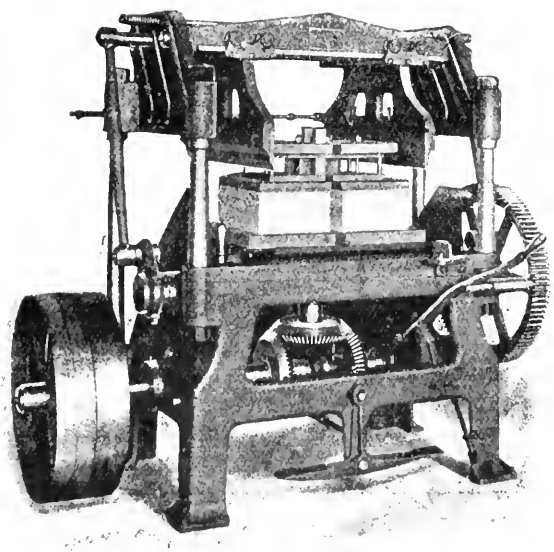

Fig. 48.

Reliable cutting machines, for hand or power, are supplied by Messrs. John Greig and Sons, Messrs. Furnival and Co., Ltd., Messrs. Harrild and Sons, Messrs. Peter Hooker, Ltd., The Seybold Machine Co., of Dayton, Ohio (whose London agents are Messrs. Valters, Jackson and Co.), The Brown and Carver Co., of Oswego, New York

whose London agents are the Canadian-American Machinery Co., Messrs. T. W. and C. B. Sheridan Co., Mr. O. Friedheim, Messrs. Hughes and Kimber, Ltd., and Mr. Karl Krause (whose London agents are Messrs. Kampe and Co.).

Greig's "New Conqueror" Guillotine.

Greig's "New Conqueror" (Fig. 46) is a typical specimen of an up-to-date cutting machine with a single knife. The knife being a long one, several small piles of books may be cut at one operation. The books

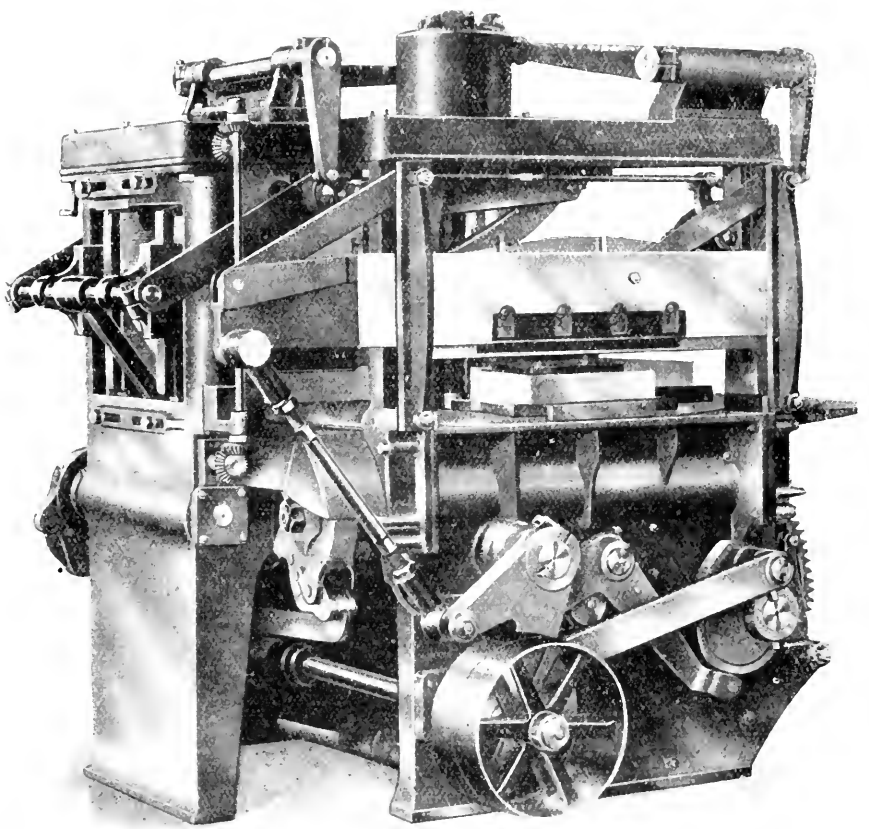

Fig. 49.

having been accurately placed on the bed of the machine according to a back gauge, one movement of the front lever suffices to start the machine and complete the cycle of operations, as it is entirely automatic in its action: the books are clamped under heavy pressure, the knife descends cutting through the paper, and returns to its first position; the clamp releases the books and the machine stops in order that the work may be removed. This machine cuts paper any thickness up to six inches, and it is estimated to give about twenty cuts per minute the highest speed at which any operator could safely manipulate his work. It is made in various sizes to cut work ranging from 30 inches to 70 inches wide.

If the books are to have their heads, tails and fore-edges cut, they must be put through a one-knife machine three times. Usually a quantity of books to be so cut are all put through the machine before the second cutting takes place, which of course necessitates an alteration of the gauge; and when all the books in the batch have had two edges cut, the gauge is again altered for the final cutting.

Furnival's "Express" Guillotine.

A very popular machine is Furnival's "Express" Self-clamp guillotine (Fig. 47) in which the clamping is usually effected by hydraulic power, but it may be fitted with a weight clamping arrangement if desired. The illustration is a view of the

machine fitted with "grid-iron" clamp and backfence, which is only supplied when specially ordered; it is also fitted with a patent silent clutch. The knife can be stopped at any part of the cut, and the pressure can be regulated to suit various kinds of work. The guillotine is made in various sizes to cut work ranging in width from 26 to 64 inches.

Seybold "Duplex" Cutter.

The Seybold "Duplex" cutter (Fig. 48) (which is sold in this country by Messrs. Valters, Jackson and Co.) is equipped with two knives which act automatically and simultaneously, so that two edges are cut at one operation of the machine, thereby doing more work in a given time than is accomplished by a machine with a single knife. In the head of the machine the cutting knives are arranged parallel to each other, and are secured to carriages mounted on bars having horizontal tracks upon which the carriages may travel. For this machine it is necessary to have a number of sets of pattern blocks of varying sizes to correspond to the different sizes of books. Two small piles of books having been accurately placed, back to back, on cutting blocks fixed to a movable table—thereby exposing to view the four edges which are to be cut—two pattern boards are selected of the size to which the books are to be trimmed and are fixed horizontally to the clamping mechanism. The gauges for the knives having been set accurately the machine is set in motion, the piles are automatically clamped, and the knives descend and cut the fore-edges. In order to bring the other uncut edges under the knives, the table is given a quarter-turn and this movement brings the knives into their correct position for the second cutting; the knives then descend and cut the heads and tails, and the piles are afterwards released from the pressure of the clamps. This machine will cut work six inches high, any size between 5 by 2½ inches up to 16 by 12 inches.

Seybold Continuous Trimmer.

A remarkable machine for effecting an enormous output in a short time is the Seybold Continuous Feed Book Trimmer which, at every single operation, delivers a small pile of books having three edges trimmed. Its distinctive features are three cutting knives, each provided with an independent automatic clamp for clamping the books during the cutting operation, and a table which revolves intermittently and carries the piles of books under the knives which operate simultaneously, so that when the heads and tails of the books in one pile are being trimmed, the fore-edges of books in another pile are also being trimmed. After the operator has placed three piles of books on the machine its action, as its name implies, is continuous, the table making a quarter-revolution at each movement. In feeding the machine the operator places a pile of books, according to a back gauge,

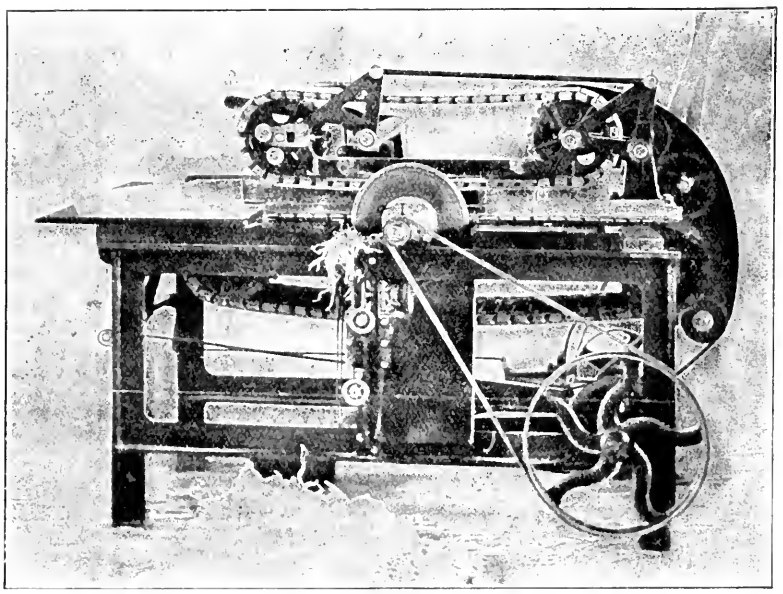

Fig. 50.

on the empty section of the table immediately in front of him while the table is at rest, and an auxiliary clamp is brought down upon the books to prevent displacement while the table rotates and until the automatic clamps carried by the knives

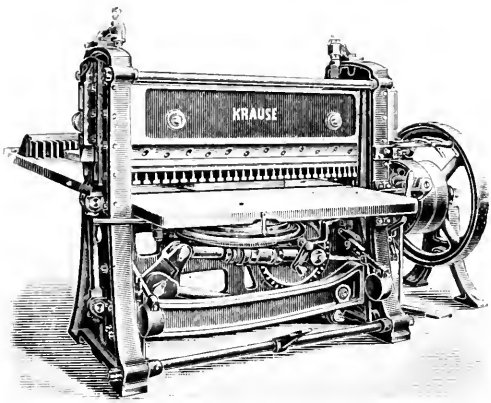

Fig. 51.

are brought into operation. The table is then automatically released and by the first quarter-revolution the pile is brought into correct position between two parallel knives, the table is locked, the clamps carried by the knives come into operation, and the knives descend and cut the heads and tails of the books; by the second movement of the table the same pile is carried under the third knife which cuts the fore-edges of the books; by the third turn the pile is brought to a delivery point where the books are removed by a boy; and, by the fourth quarter-revolution the empty section is brought in front of the operator. The operator is entirely eliminated from danger as the nearest knife is three feet from him. The machine is estimated to trim six hundred piles per hour of any size from a minimum of $3\frac{1}{2}$ by 6 inches to a maximum of $13\frac{1}{2}$ by 18 inches and 6 inches high; and the change from one size to another is simply and quickly effected.

Oswego Continuous Trimmer.

Another effective machine deserving of particular notice is Brown and Carver's Oswego Continuous Trimming Machine (Fig. 49) (sold in this country by the Canadian-American Machinery Co.) which, in its construction and general operation, resembles the Seybold Continuous Trimmer. The operator places a pile of books to be cut on a rotating table against a side and back gauge. The pile is clamped by automatic pile-holders and the table is then given a quarter-turn in order to bring the pile between two adjustable knives; these knives descend and cut two sides of the pile in one operation after the automatic clamps have come down and grasped the edges of the pile firmly. The table is then given a second quarter-revolution to bring the pile under the third knife and automatic clamp for the third cut. The third movement of the table brings the pile to the fourth position where the pile-holder automatically releases the pile so that it may be easily and quickly removed. The machine is designed to cut books of any size from $3\frac{1}{2}$ by 6 inches up to $13\frac{1}{2}$ by 18 inches.

Mercer Trimming Machine.

For trimming books that are to have deckle-edges the Mercer Continuous Book Trimming Machine (Fig. 50) (sold by Mr. Oscar Friedheim) may be usefully employed. This machine, about 6 feet 3 inches in length and 4 feet 3 inches in width, has a suitable table upon which the books to be trimmed are placed in readiness for the operator. Fixed to the right-hand side of the machine, near the middle, is a circular cutting knife. After the back gauge has been set, so that the knife will cut off

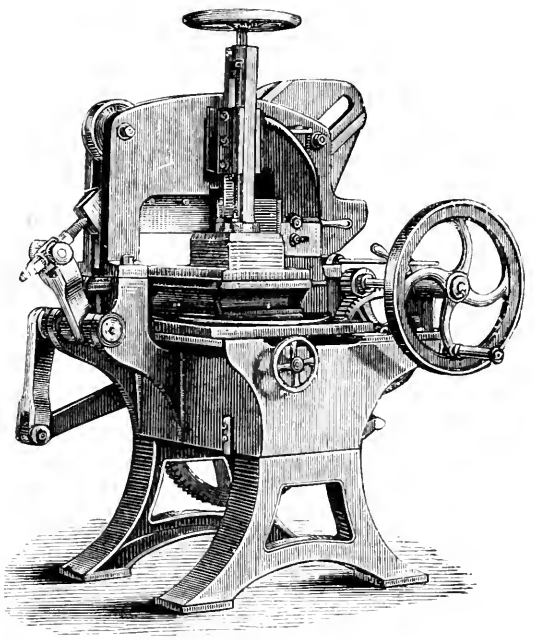

Fig. 52.

the desired amount from the edge of the books, the operator places a book against the back gauge and then pushes it along the table until it is gripped be-

tween two horizontal endless chains, made of a series of metal cross-bars. The operating surfaces of the chains are

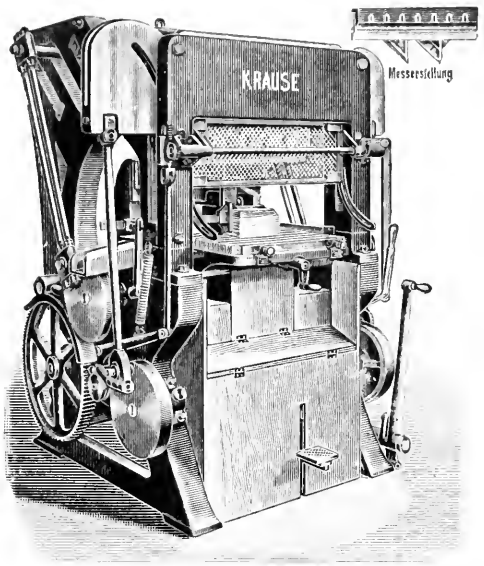

Fig. 53.

parallel to each other. The upper chain presses down upon the upper side of the book and the lower one carries the book past the rapidly revolving cutting knife (driven by an ordinary driving belt) in such a manner as to bring the fore-edge in contact with it. These chains, of course, also serve to deliver the book at the rear of the machine where they are removed by a boy. Mounted on the machine is an emery wheel for sharpening the knife-edge of the disc from time to time. The machine will operate on books of different thicknesses; by one adjustment the pressure on the work may be regulated, as the wheels carrying the upper chain are mounted in a frame capable of rising or falling as may be required. The machine will trim books from 15 inches square down to 4 inches square, and one, two, or three books may be fed at each operation, estimated to give an output per hour of 1,800, 3,600 and 5,400 books respectively.

Krause's Cutting Machines.

The best-known of Krause's cutting machines (which are sold in this country by Messrs. Kampe and Co.) is his "Rapid" guillotine (Fig. 51) which has the following features: a friction clutch, an arrangement for the automatic stoppage of the knife when in its highest position, an arrangement for throwing in and out of gear at any part of the cut, a cut indicator (to show the exact line of the cut before the descent of the knife), an adjustable table, and a parallel adjustment to provide against either under or over cutting. The machine is estimated to make twenty cuts per minute, and is made in four sizes, the length of cut of the smallest size being 40 inches and the largest 70 inches.

The three-sided cutting machine (Fig. 52) trims books in piles up to $5\frac{1}{2}$ inches high, on three sides with only a single clamping; after the first cut the revolving table, which is turned by hand, automatically locks itself in exact position ready for the next cut, and the operation is repeated for the third side of the pile. A different clamping plate is required for each size of book to be cut. The machine is made in five sizes; the smallest size will cut work from $2\frac{3}{16}$ by $3\frac{13}{16}$ inches up to $7\frac{1}{16}$ by $9\frac{7}{8}$ inches, and the largest will cut work from $11\frac{1}{16}$ by $19\frac{13}{16}$ inches up to $19\frac{7}{8}$ by 23 inches.

Krause's new "Rapid" three-side trimming machine (Fig. 53) has three knives which will cut in one operation the three sides of a pile of books or magazines. The piles may be as high as $6\frac{7}{8}$ inches and may vary in size from $2\frac{1}{4}$ by $4\frac{1}{2}$ inches to $19\frac{3}{4}$ by $22\frac{1}{4}$ inches. The front knife requires no adjustment, and the two side knives may be set in a few minutes by means of two cranks along a scale marked in inches.

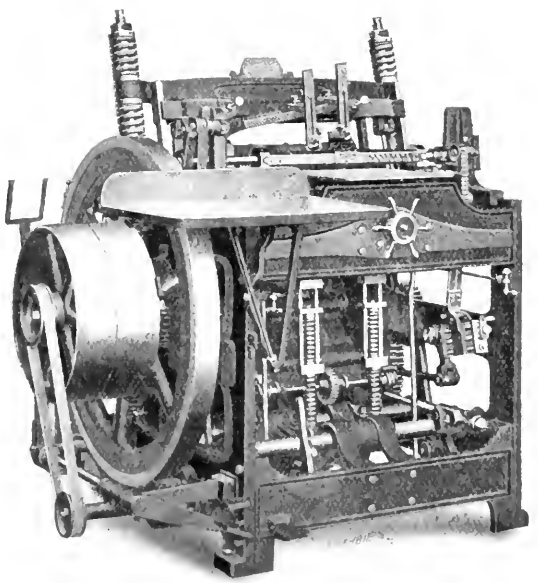

Fig. 54.

The material is fed to two back gauges and a side gauge which automatically recedes when the knife descends. The foot clamp shown in the illustration serves to hold the pile of material in position until the knives descend, when the automatic self-clamp comes into action and grips the material firmly until the three cuts have been completed.

Glueing-up.

When the book has been trimmed it is ready for "glueing-up," a process which is still done by hand. The back of the book is, or should be, well brushed over with a thin coating of glue to hold the sections firmly together. After the glue has ceased to be "tacky," but before it has become dry and hard, the book is rounded and backed.

Rounding and Backing.

The operations of rounding and backing are very important and great care should be exercised in their execution. If the sewing or the backing process has been imperfectly executed the book will not last long, however well the subsequent operations may have been performed. The object of rounding the backs of books is to prevent their assuming a bad convex or concave shape, or perhaps a combination of the two; and the books are backed to provide the necessary grooves in which the boards should fit. In earlier days this work was done by hand with a hammer, and this practice still obtains in ordinary binding. In hand-work the back is rounded by being laid flat on a table and then tapped first on one side of the back and then on the other. The book is next put between a pair of backing boards and placed in a lying press, with the back of the book projecting sufficiently to allow the proper grooves to be made; this is done by striking the back with a hammer in such a way that the folds of the outer sections are turned over, forming the grooves.

The Crawley Machine.

The Crawley Rounding and Backing Machine (Fig. 54) (sold by The Hobbs Mfg. Co. and Messrs. T. W. and C. B. Sheridan Co.) rounds and backs each book by one continuous action, at estimated speeds varying from 350 to 750 books per hour, according to the nature of the work, the ability of the operator, and the size of the machine. The operator in feeding the machine holds the book in both hands and inserts it between a pair of rounding rollers so that the back of the book rests against a pair of guides which have previously been accurately set. The rollers also having been properly adjusted, the upper one now descends and presses the book between it and the lower roller. The guides then rise out of the way, and the rollers rotate sufficiently to round the back and to move the book rearward far enough to pass it between a pair of jaws; the back of the book then projects sufficiently beyond the rear edge of the jaws to enable the backing device to form on the book joints of the proper size. The jaws then grasp the book firmly, the rollers release their grasp and the jaws swing rearward, bringing the book in contact with an oscillating backing plate. The backing plate is of cast iron and has a concave polished face. This plate, which describes an arc in its movements, first touches the centre of the back of the book and then by two or three movements turns the ends of the sections both ways evenly from the centre and forms the joints for the boards. The pressure which the backing plate exerts upon the back and joints of the book may be regulated. The book having been backed, the jaws move forward towards the operator and release their grasp of the book; before this movement is completed another book has been inserted between the rounding-rollers so that the book between the jaws is pushed out by the second book, which takes its place between the jaws. The first book is then removed by the operator. The upper roller is adjustable so that thin and thick books may be gripped equally well, and a number of backing plates are provided with each machine, as it is necessary to use a plate $\frac{1}{4}$ inch wider than the thickness of the book to produce a correct joint; this joint should be the same size as the thickness of the boards used for the covers. The Crawley machine can be had in three sizes: the small size will take books 3 inches to 10 inches wide, $2\frac{1}{2}$ inches to $12\frac{3}{4}$ inches high or long, and $\frac{1}{8}$ inch to $1\frac{3}{4}$ inches thick, at a fast speed of fourteen or a slow speed of nine books per minute; the standard size will take books $3\frac{1}{2}$ inches to $10\frac{1}{2}$ inches wide, $2\frac{1}{2}$ inches to $12\frac{3}{4}$ inches high or long, and $\frac{1}{8}$ inch to $3\frac{3}{4}$ inches thick, at a fast speed of eleven or a slow speed of seven books per minute; the extra large size will take books $3\frac{1}{2}$ inches to $11\frac{1}{2}$ inches wide, $2\frac{1}{2}$ inches to 17 inches high or long and $\frac{1}{8}$ inch to $3\frac{1}{4}$ inches thick, at a fast speed of nine or a slow speed of six books per minute.

The "Rupert" Machine.

The "Rupert" Rounding and Backing Machine (sold by Messrs. Valters, Jackson and Co.) is similar in construction to the Crawley machine as the patent of the earlier pattern of the latter has expired, but there are still some patented improvements on the latest model of the Crawley machine. It is constructed to take books 3 inches to $10\frac{1}{2}$ inches wide, $2\frac{1}{2}$ to $12\frac{1}{4}$ inches long, and $\frac{1}{8}$ inch to $2\frac{1}{2}$ inches thick and the estimated output is 600 to 700 books per hour.

Lining, etc.

The next process is lining. The strength and flexibility of the back depends upon the materials used and the care taken in applying them. The back receives its second coating of glue and a strip of mull or super (slightly less in length than that

of the book, but considerably wider than the thickness of it) is attached. A strip of brown or other strong paper, the width of the back, is put on top of the mull and rubbed down firmly with a folder or rounded stick; in the case of large and heavy books their backs are generally strengthened by having two or more pieces of paper glued to them in the same way. If the books have gilt tops, headbands are affixed to both the head and tail of each book. When the books are dry they are ready for "casing-in"; that is to say, the book is ready to be enclosed in a book-cover or "case." By this method the cover for the book may be made in another department of the bindery while the preceding operations are being performed.

Casing versus Binding.

There is a fundamental difference between the methods of attaching the covers of a "cased" book and a "bound" book. In casing a book, whether the covering material be boards, cloth, buckram, or leather, the sides of the book are pasted and the ready-made cover is simply attached to them; there is thus no structural connection between the sheets of the book and the cover. In binding a book, using the term in its correct technical meaning, the slips are firmly secured to the boards, and the complete cover forms an integral part of the structure of the book.

Boards.

The work of case-making is now done entirely by machinery. The case-making machines must necessarily produce cases uniformly in size one with another, and

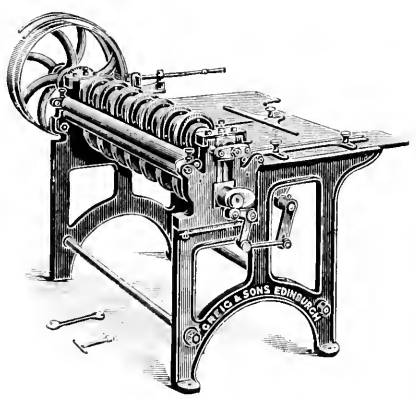

Fig. 55.

there is an entire absence of finger-marks, lumps, brush-marks, and so forth, which are liable to occur on cases made by hand. The first stage in the making of the cover is to prepare boards of the required size for the book. The cutting of boards a few at a time, hitherto performed by a lever cutting machine having a descending knife, is now done more expeditiously by a rotary cutting machine driven by steam or electric power, of which there are a considerable number in use. A rotary cutting machine consists of an iron table having a planed surface, parallel feed gauges, and several pairs of adjustable circular cutters. The steel cutters revolve on two spindles, the upper cutters working against the lower ones in shear fashion. Two feedings are necessary to obtain boards of the required size for book-covers. The cutters are first adjusted for cutting the sheets of boards into strips; a sheet of board is then fed between a pair of steel rollers which force the board against the revolving cutters; these cutters divide the boards into strips and they are delivered by means of another pair of steel rollers. The strips are subsequently put through the machine after the cutters have been adjusted, and thus cut into boards, all perfectly accurate in size.

The firms of Furnival and Co., Ltd., O. Friedheim, Karl Krause, T. W. and C. B. Sheridan Co., Richmond and Co., and John Greig and Sons all make rotary cutting machines, some of which have as many as ten pairs of cutters. Greig's millboard cutting machines (Fig. 55) will cut flat boards from $\frac{5}{32}$ to $\frac{1}{4}$ inch. These machines are of different widths and may be supplied with any reasonable number of cutters: the bookbinders' size is 42 inches wide between frames or cheeks, and is provided with seven pairs of cutters.

Smyth Cloth-Cutting Machines.

If the cases are to be made by the Smyth Case-making Machine, the cloth must first be cut up into rectangular sheets of the proper size for the cases which are to be made: that is to say, the sheet of cloth must be sufficiently large to overlap the boards by about $\frac{1}{2}$ or $\frac{3}{4}$ inch. For this purpose the Smyth Cloth-cutting Machines (Fig. 56) are used. These machines are constructed to take a roll of bookbinders' cloth of the standard length and diameter and to cut accurately rectangular sheets in only a fraction of the time that would be occupied if the work were done by hand. It is quite obvious that such a machine possesses the additional advantage of cutting the cloth more economically than would be done in practice by hand. The cloth is automatically fed over and through a straightening device consisting of adjustable rods, in order to remove the curl completely; it then passes through the feeding-in rubber rollers which draw the cloth between a series of circular cutters for the purpose of slitting it lengthwise. The feeding-in arrangement is adjustable, and its action is intermittent; after the cloth has been drawn between the cutters for the desired distance, there is a pause, and the knife descends crosswise, cutting the longitudinal strips into rectangular sheets. The sheets are then delivered upon the receiving table. The No. 1 machine will cut and deliver rectangular sheets of any size varying from the full width of the cloth by

24 inches, to 3 inches by 5 inches; the No. 2 machine is similar to the one just described, but its feeding-in arrangement permits the cloth to be cut to its full width by 36 inches. These machines are equipped with a rewinding attachment so that any portion of the roll not cut into rectangular sheets may be rolled again for future use.

Smyth Case-Makers.

The sheets are next prepared for the Smyth Case-making Machine (Fig. 57) by being placed in a corner-cutting device and having their corners nipped off. A pile of sheets so cut is placed on a table to the left of the operator of the case-making machine. The operator feeds a sheet of cloth, reverse side uppermost, to the gripper fingers of a cylinder which simply grip the front edge of the cloth. This cylinder in rotating causes the cloth to fall away from it and the whole of the under surface of the cloth comes into contact with a roller which revolves reciprocally in a tank containing glue kept at the necessary heat by gas burners. The roller that applies the glue is fitted with two scrapers, one to scrape it clean and the other to regulate the quantity of glue that is to be applied to the fabric. The cloth is then automatically carried on to a platform in the centre of the machine and a picker, by means of suction, lifts and carries a pair of boards from the hoppers at the rear of the machine, containing piles of boards cut to the requisite size, and correctly places them on the glued fabric. If the back lining is to be of thick paper it is automatically cut from a reel at the rear of the machine and fed on to the case, but if thin boards are to be used for this purpose they are applied by hand—work usually done by a boy. The platform then descends and the cloth is folded over head and tail and at the same time the corners are nicked in. After a momentary pause to allow the head and tail folds to adhere to the boards, the second folding bars come

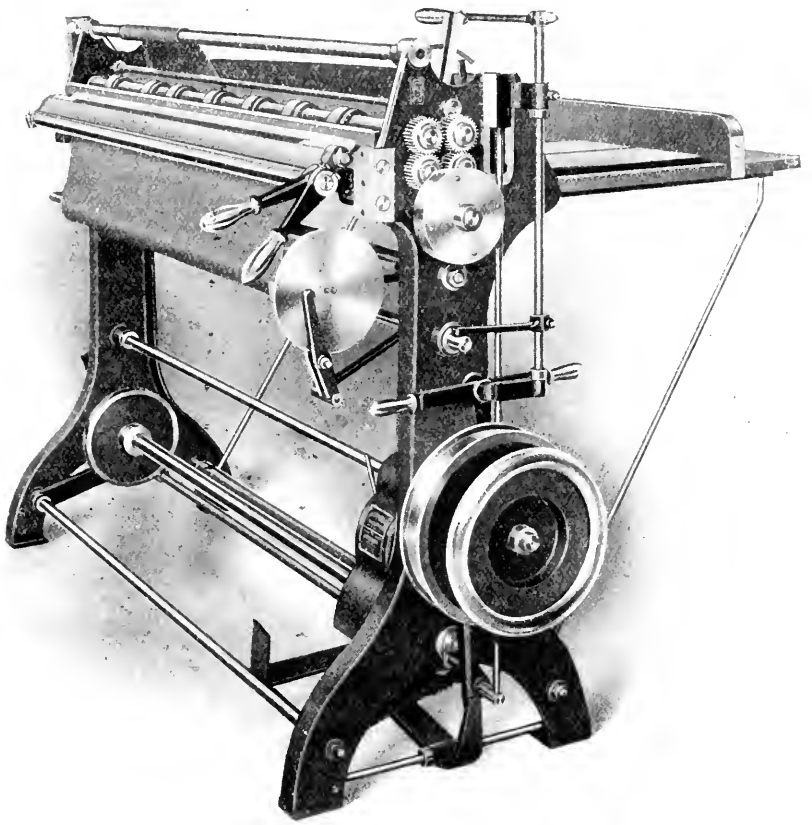

Fig. 56.

into operation and these fold the fabric over the fore-edges. The case is then run into a press and remains under pressure while the next case is being made. The pressing arrangement is ingeniously adapted to suit the various thicknesses of boards and widths between the boards. It consists of a flat indiarubber bag filled with water, on to which the case is placed, and a platen, which lowers at its proper time and presses the case on to the bag; the bag, being flexible, rises in the hollow between the boards, thus properly pressing the whole cover. At the proper time the press opens, delivering the finished case on to an automatic lowering table. A boy is occasionally required to remove the piles of cases from the table, and to keep the machine supplied with materials.

The No. 1 machine (Fig. 57), is designed to run at a speed of 10 to 12 cases per minute, or about 600 to 700 per hour, and to make cases $5\frac{1}{2}$ by $7\frac{1}{2}$ inches up to $9\frac{1}{2}$ by $15\frac{1}{2}$ inches. An attachment can be incorporated with this machine to make cases $3\frac{3}{4}$ by $5\frac{1}{2}$ inches to $6\frac{1}{2}$ by $8\frac{1}{2}$ inches. The No. 2 machine (Fig. 58) resembles the one just described, but is heavier in construction and is modified in details to manipulate heavier work. It is designed to run at a speed of 8 to 10 cases per minute, or about 450 to 600 per hour,

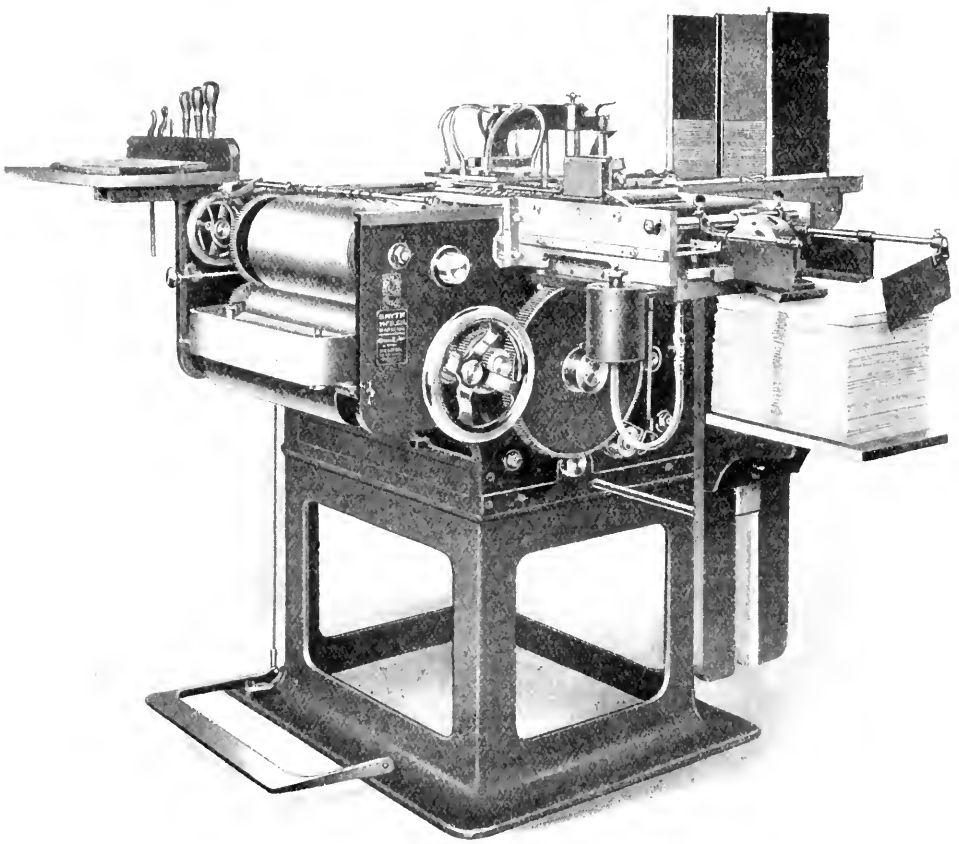

Fig. 57.

and to make cases of all sizes between 7 inches by 11 inches and 14 by 22 inches. An attachment may be incorporated to make cases 7 by 7 inches to 7 by 11 inches. The Special No. 2 machine has an increased range, being adapted for making cases from 7 by 7 inches to 16 by 22 inches, and it is equipped with a round-corner attachment.

The machines will make cases from

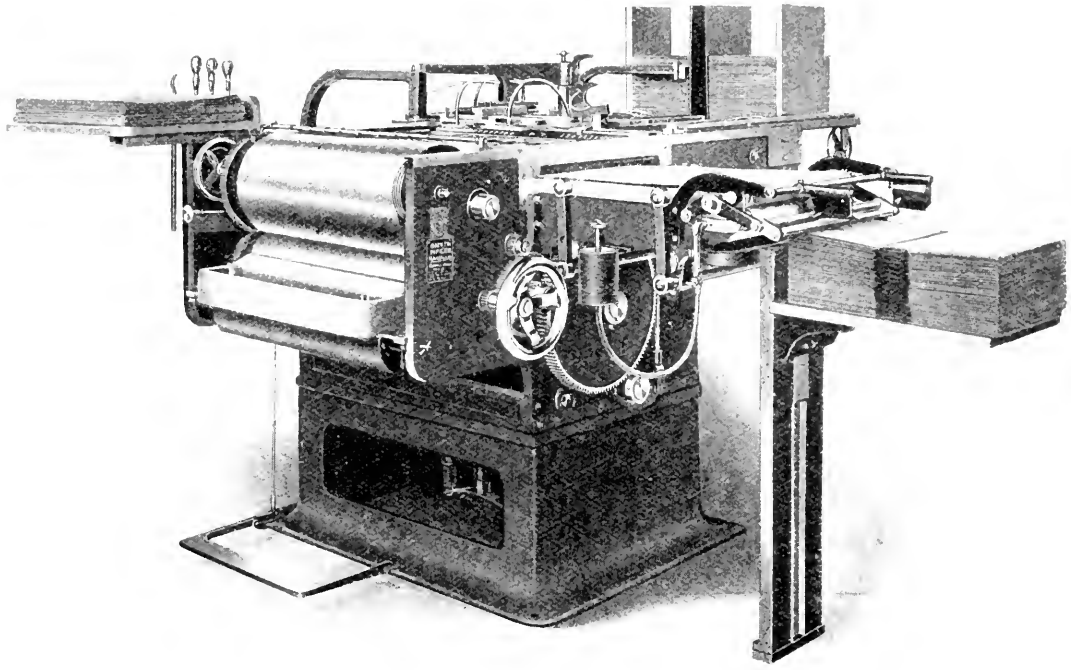

Fig. 58.

boards with either square or bevelled edges, using either plain or grained bookbinders' cloth, calico, linen, the basket or open mesh cloth, also plain or printed paper-covers. These machines will also produce cases with backs of a different material to that used on the sides, or similar material but of a different colour. Cases so made pass twice through the machine: in the first working the boards are joined together by the back strip of cloth or paper; in the second working the semi-made cases are placed in the hopper, and a siding-up attachment is placed in position in the machine; the two pieces of material to cover the sides are then fed to the machine and the cases made as previously described.

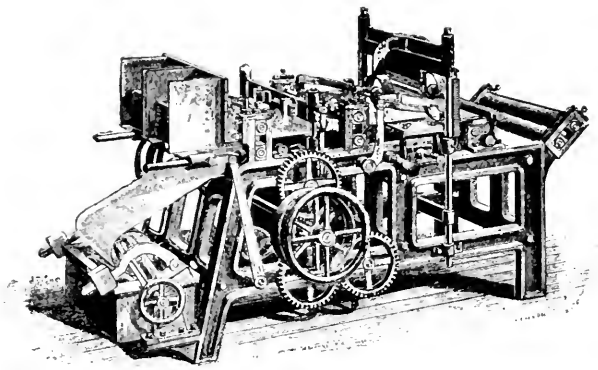

Fig. 59.

Sheridan Case-Maker.

The Sheridan Case-making Machine (Fig. 59) is larger than the Smyth machine, and being more complex, considerably longer time is occupied in setting it up for working cases of a particular size, and it is therefore of greatest service when very long runs are required; but having been adjusted, the actual output of the Sheridan machine per hour exceeds that of the Smyth case-maker. In operating this machine, it is first necessary to cut the ordinary rolls of cloth (about 36 to 44 inches in width) into rolls of a width requisite for the cases it is desired to make, and for this purpose a special cloth slitter and rewinder is supplied with the machine. A roll having been fixed to the machine, the reverse side of the cloth is automatically pressed into contact with a cylinder which revolves in a tank of glue, and the cloth is thereby coated with a suitable quantity of glue. The glued cloth is then carried over rollers, and pairs of boards, cut to the proper

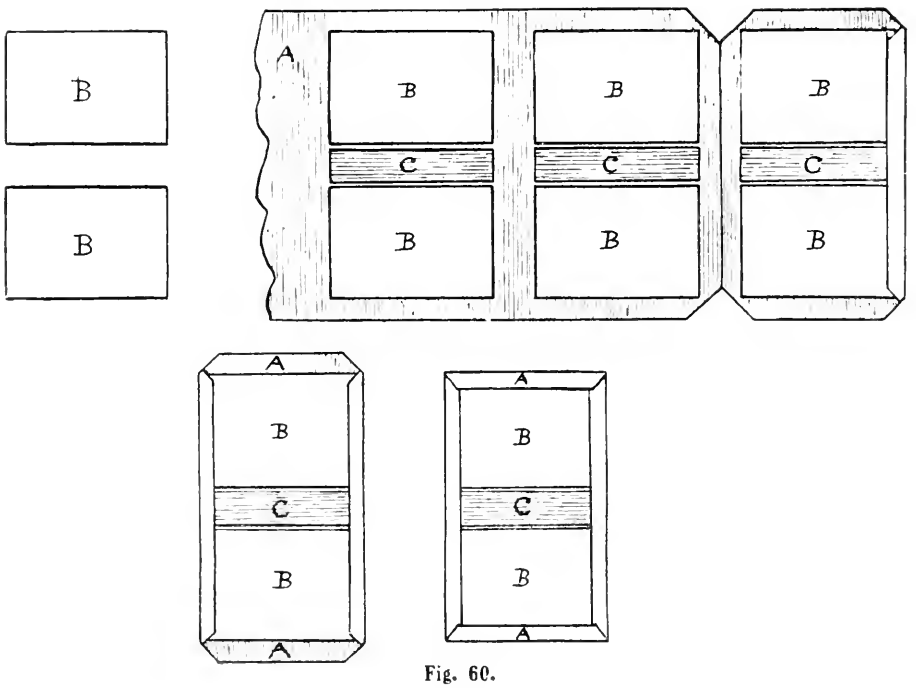

Fig. 60.

size, are successively fed on to the cloth from a magazine or hopper by reciprocating pushers. Each pair of boards is fed simultaneously, the two boards being placed in correct position relatively to each other and to the successive pairs, in order to provide the requisite amount of cloth for turning in. The fabric now carrying the boards passes between rollers which not only press the boards firmly to the cloth, but give to it a forward movement. A knife, provided at each end with a small **V**-shaped cutter, then cuts across the cloth midway between each two successive pairs of boards, thus cutting the corners to the correct shape. If a stiffening strip is to be applied to the case, it is fed automatically in suitable lengths from a hopper, after which the advancing edge of the cloth is folded over the boards and pressed down by a roller, and the rear edge is turned forward and also pressed down by another roller. These rollers are both wider in diameter at the middle, in order that the overlapping ends of the cloth between the boards may be pressed down. Another roller then passes between the two boards of the pair to press the back lining to the back of the cover. Afterwards the side flaps are folded over and pressed down by side rollers, and the case is then delivered in a trough, being subsequently passed through the case-smoother by the assistant. Fig. 60 shows the successive stages in the making of cases on the Sheridan case-maker; the cloth is lettered A, the boards are lettered B, and the stiffening strips are lettered C. This machine with the aid of one man and a boy or girl will make cloth cases with either square or bevelled edges, from $8\frac{1}{2}$ by $5\frac{1}{2}$ inches up to 17 by 11 inches, at an estimated speed of about 1,000 cases per hour.

Decoration of Covers.

The cover is now ready to receive its title and any ornamentation that may be desired. Cloth book-covers may be decorated by embossing, blind-stamping, stamping in gold or alloyed metals, or printing in colour, or by a combination of some of these processes.

For blocking in "blind" (*i.e.*, the impressing of the die directly on to the book-cover without the use of any foil or ink) or in gold and for printing in colour, dies or blocks cut in relief are required. If the cover is only to be blocked in blind or gold or printed in one colour, a single die will suffice, but if two or more colours are required, a separate die must be made for each colour (each die of course requiring a separate working) unless the colours are to be "blended" in such a way that the colours are applied in bands across or up and down the cover. Usually the maximum number of colours is four, and more frequently only one or two are used, with or without the combination of gold. Needless to say, great accuracy must be observed in the making of the various dies for one cover, as it is most essential that they should register correctly. In order to get a good sharp impression the die is made of brass if the number of covers to be blocked or printed is a large one; but if the number be comparatively small an electro is used as its cost is considerably less than that of a brass die.

There is an enormous variety of machines for doing the work of blocking and printing, and it would be impossible to enumerate them all; however, the principle upon which these machines work is practically the same in all cases. The block is fixed to an upper plate or "platen" situated in the head of the machine under a heating box which is kept at correct and constant temperature by means of efficient gas jets or jets of steam running through it. To attach the block to the platen various adhesives are used; usually a sheet of brown paper is first glued to the platen and then the block is glued to it. The bed or lower platen of the press is provided with lay gauges so that the covers to be stamped may all be fed in exactly the same position. Blocking in blind is only suitable for cloth having a rough or grained surface; on cloth having a smooth surface the effect of blocking is not apparent. When blocking in gold or other metal foils the cloth book-covers are not prepared with any adhesive medium if the work is to be turned out as cheaply as possible, the composition of the cloth and the glue beneath it being depended upon to provide the necessary agglutination. In the better-class work, however, the cloth is prepared by "washing"; probably the oldest form of adhesive is the glaire of eggs, but for commercial work this has now been largely superseded by dried albumen or blocking powders.

A cover having had the gold leaf laid on by hand as for hand tooling, it is placed on the lower platen and then brought in contact with the heated die which gives the impression and fixes the gold leaf wherever it has touched the cover. The superfluous gold is then rubbed off with a rag or piece of rubber, leaving the ornamentation visible.

For blocking in relief a die of hardened brass cut in intagho (known as the female die) and a raised counter die (known as a "force" or the male die) made up of millboard, sugar-paper or papier-maché, are required. The female die is fixed on the upper platen and the male die is attached to the lower platen in a corresponding position. The machine is worked as for stamping, heat, of course, being required, and the interposition of the book-cover between the two dies causes its surface to be raised.

Colour printing to be effective requires a smooth cloth, and frequently each colour requires a second coat to give a good effect. The process of printing covers with inks of different colours is done without heat, and frequently some of the platen printing presses are used, such as Colt's Armory platen press, style 6 machine.

The inking arrangement carried in the head of the machine consists of a duct to supply the ink to rollers which automatically ink the block while the operator is feeding the cover. In many of the machines the duct may be divided in order to contain inks of several different colours, so that more than one colour may be applied at one impression; but the application of several colours at one time is limited by the design.

"Beatrice" Press.

Messrs. Valters, Jackson and Co.'s "Beatrice" press (Fig. 61) is a typical one adapted for embossing and blocking in blind and gold and printing in ink. This machine is set at an angle with the view of attaining a high rate of speed, estimated at 1,000 impressions per hour, with accurate register and good impression. The top platen is so arranged that when drawn out it folds up, in order

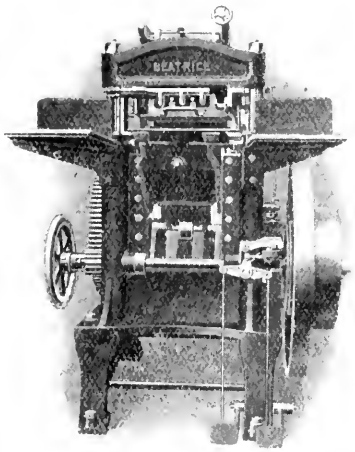

Fig. 61.

that alterations to the block may be made conveniently without removing it from the machine. A book-cover having been placed on the bottom platen, which has an in-and-out movement, it travels in as it rises under the head of the machine, and the book-cover is pressed firmly against the die; the bottom platen then descends and moves out again, allowing a rest sufficiently long to permit the cover to be taken off and another placed on. This machine is made in three sizes: two machines have a blocking surface 12 inches by 10 inches, and a bottom table 13 by 11 inches, and the other machine has a blocking surface 16 by 14 inches and a bottom table 18 by 16 inches. The inking arrangement of this machine is carried in the back part of the head and can easily be disengaged when blocking in blind or in gold.

Kampe's Presses.

Messrs. Kampe's and Co.'s "Rock" gold blocking and embossing press No. 3a for hand power (Fig. 62) is fitted with atmospheric gas burners, and is made in five sizes; the smallest size has a bed $15\frac{3}{8}$ by $15\frac{1}{4}$ inches, and a blocking plate guaranteed to block covers $9\frac{1}{2}$ by $13\frac{1}{2}$ inches; the

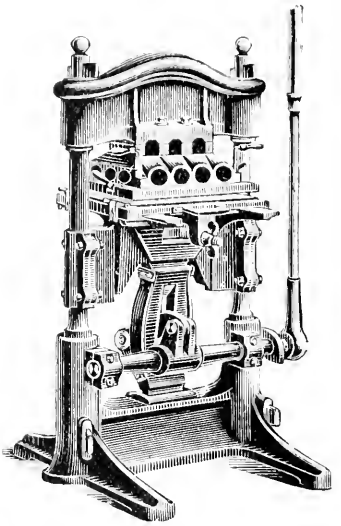

Fig. 62

largest size has a bed $22\frac{3}{4}$ by $23\frac{1}{2}$ inches and a plate for blocking covers up to $16\frac{1}{2}$ by 21 inches. The "Rock" gold blocking and inking press No. 2 (Fig. 63) is also fitted with atmospheric burners and arranged for hand power. It is adapted for

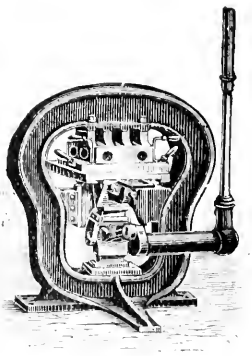

Fig. 63.

smaller work and is made in two sizes; size No. 1 will block work $6\frac{1}{4}$ by $7\frac{3}{4}$ inches, and size No. 2 will block work 7 by $8\frac{3}{4}$ inches.

Friedheim's Presses.

Mr. Oscar Friedheim's blocking and embossing presses cover a very wide range to meet the various requirements

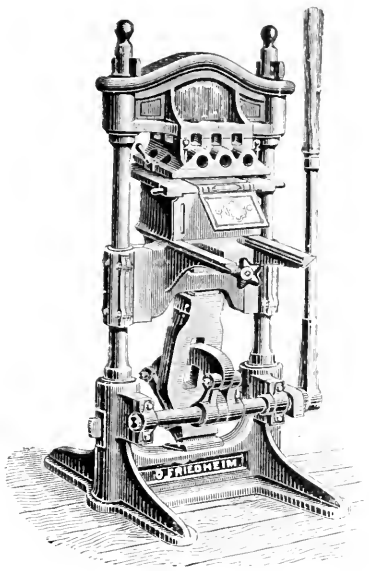

Fig. 64.

of bookbinders. One of his presses can be furnished with an automatic colouring apparatus for producing in one operation coloured and blocked book-covers. The machine is arranged for power, and the estimated number of impressions per hour that can be obtained is 1,000. The machine is fitted for gas heating with atmospheric burners, unless an arrangement for steam is specially required, and the size of the heating box and of the hanging plate is 8½ by 10½ inches.

Fig. 64 illustrates his press No. 1020 for hand-power which is fitted with a high insertion box and an adjustable table for the book-cover to rest upon whilst in the press. The box can be regulated to suit the size of the book-cover to be worked. This comparatively light machine, which is usually fitted for gas heating with atmospheric burners, is made in eleven sizes: the smallest size has a heating box 8½ by 11 inches and a hanging plate 9½ by 12½ inches, and the largest size has a heating box 21½ by 27½ inches and a hanging plate 22 by 29½ inches.

In contrast to Fig. 64 an illustration (Fig. 65) is given of his heavy four poster blocking and embossing press, No. 1034, arranged for power, which is a very powerful machine, being capable of exerting a pressure of about 400 tons. A pressure indicator can be fitted in order to show the amount of pressure being exerted. This press is fitted for gas heating with atmospheric burners, and it has a heating box 25½ by 33½ inches and a hanging plate 28½ by 33½ inches.

An illustration is also given of Friedheim's double-sided blocking and embossing press (Fig. 66) for two operators. This machine is also fitted for gas heating with atmospheric burners, and is made in four

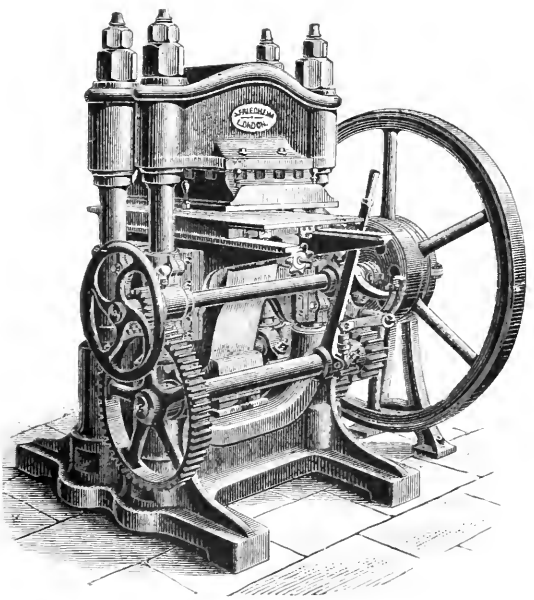

Fig. 65.

sizes; the smallest size has a heating box 13 by 16⅞ inches and a hanging plate 13¼ by 19 inches; the largest size has a heating box 19¼ by 23⅞ inches and a hanging plate 20½ by 26 inches. The tables move automatically in and out in adjustable V-shaped guides, and either can be immediately disconnected without interfering with the other. The machines, according to their sizes, give pressures estimated at 140, 175, and 225 tons respectively, and they are fitted with a pressure indicator to enable the operator to see the amount of pressure the machine is exerting.

Sheridan Presses.

The T. W. and C. B. Sheridan Co.'s arch presses (Fig. 67) are massive and strong, and are made in two sizes; the No. 3 press has a head 15 by 13 inches, and a bed 19 by 14½ inches, and can be supplied either for embossing only or for embossing and inking; the No. 5 press has a head 18 by 15 inches and a bed 23 by 17½ inches, and is made in three styles, viz., for smashing, for embossing, and for embossing and inking.

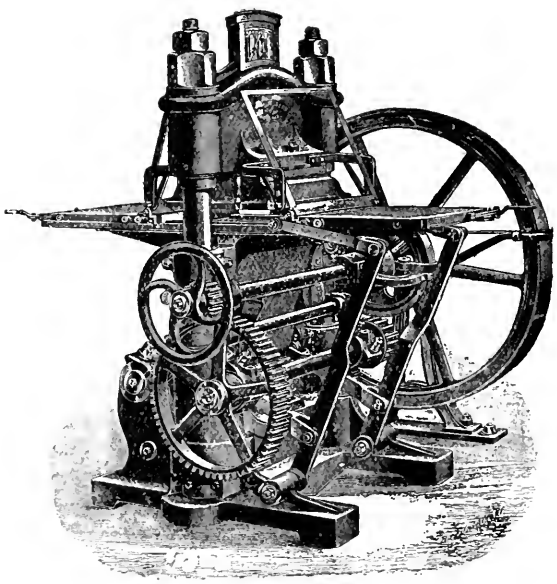

Fig. 66.

Smyth Casing-in Machine.

The case having been made and ornamented, it is ready to be combined with the book. The Smyth Casing-in Machine (Fig. 68) performs the work of casing-in in a more satisfactory manner than is usually done by hand, and runs at an estimated speed of 10 to 15 books per minute, giving an output of about 500 books per hour. This machine is equipped with three radial arms, each holding a vertical book-supporting plate. In working the machine a lad opens an unbound book near its middle and places it correctly, by means of a gauge, on the book-supporting plate attached to the arm nearest to him. The arm then makes a third-revolution, bringing the book into the centre of the machine. It then descends to lowermost position, and, to prevent the leaves of the book opening as the book travels down, air at considerable pressure is forced against each side of the book by a pair of nozzles. Two rollers supplied with paste by reciprocating paste-boxes, are now presented to either side of the book and they apply a greater amount of paste near the joints and to those portions of the book having mull than to the other portions of the sides. This ingenious application of paste is effected by the rollers being made to rotate backward at the time the book is descending, so that the peripheries of the rollers may be coated with an extra quantity of paste. The two paste rollers are each fitted with an upper and lower scraper, which can be easily adjusted by the operator to suit any thickness of joint and quality of end-paper. As the book commences to rise a case from the magazine or hopper at the rear of the machine is automatically fed into a position directly above the book. In the meantime the jointing-in device has been brought immediately above the case into which the book is to be fixed; this piece of mechanism stretches the back of the case across the back of the book, firmly forces the case into the joints, and swinging arms come down firmly, pressing

the sides of the case against the sides of the book. After the book reaches its upper limit the arm makes a third-revolution and the book is removed by the operator. The machine is adapted for books of any size, the covers of which may be made on any of the Smyth case-making machines; the covers may be as small as 4 by 7½ inches, or as large as 14 by 22 inches, and the thickness of the book may vary from ¼ inch to 3 inches. The machine will also case-in "flat back" and "tight back" books. The backs of the latter must be glued by hand immediately before they are fed to the machine and when they are removed the operator draws his hand once or twice across the back of each book, so on to the book blade, the knife edge of which enters the middle of the book, thus making it unnecessary for the operator to open the book. An automatic pusher places the book in its correct position on the blade. The book-blade has a pendent extension situated immediately above a tank holding paste or other adhesive material, and as the blade descends the pendent extension dips into this tank. The paste in the tank is kept at a constant level by an auxiliary reservoir containing sufficient paste for half-a-day's working. The pasting device consists of a pair of plates, one on each side of the blade, timed to move in and out as the book-blade rises and falls. When the book-

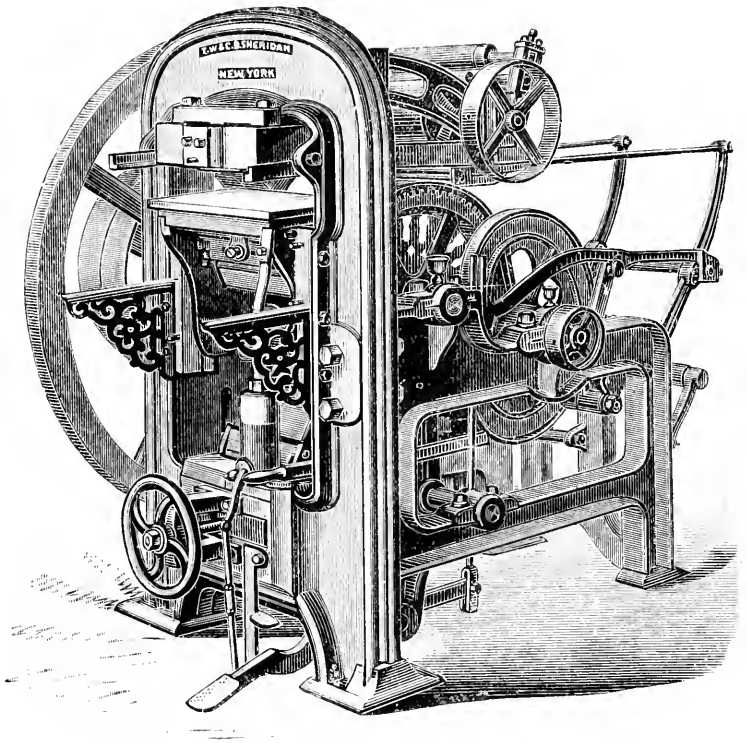

Fig. 67.

as to set the back joint. Tight-back books, although not very common in this country, are largely used on the Continent.

"Parkside" Casing-in Machine.

Another machine for casing-in is the "Parkside" Casing-in Machine, (Fig. 69), (sold by Mr. Oscar Friedheim) which was placed on the market in 1908. In feeding this machine the book to be cased is placed on its fore-edge in a bell-mouthed guide which supports it; the book is then pushed forward by hand blade is in its uppermost position, the pasting plates advance into contact with the pendent extension, which has just emerged from the paste-pot and has risen between adjustable scrapers for removing the superfluous paste. There are two sets of scrapers: one set regulates the amount of paste on the pendent extension, and the other set, consisting of a series of short scrapers, is provided to remove entirely the paste from the blade at the head and tail of the book, and thus obviate smearing its edges. As the pasting plates recede

the book-blade descends, and when it has reached its lowermost position the plates advance and apply the paste to the sides of the book. The pasting plates are so arranged that they get right into, and leave an extra supply of paste in the joints of the book. The application of this extra amount of paste at the joints is the result of a recent improvement and is effected as follows: when the pasting plates are

hopper containing a pile of cases and the bottom one is automatically drawn out and fed on to a device for rounding the back and forming the joints. This device consists of a suitably heated "former" which is rounded on the top and has a longitudinal groove at each side for forming the joints. The lower edges of two inclined blades are directed into the grooves and, by applying pressure to the back of the case,

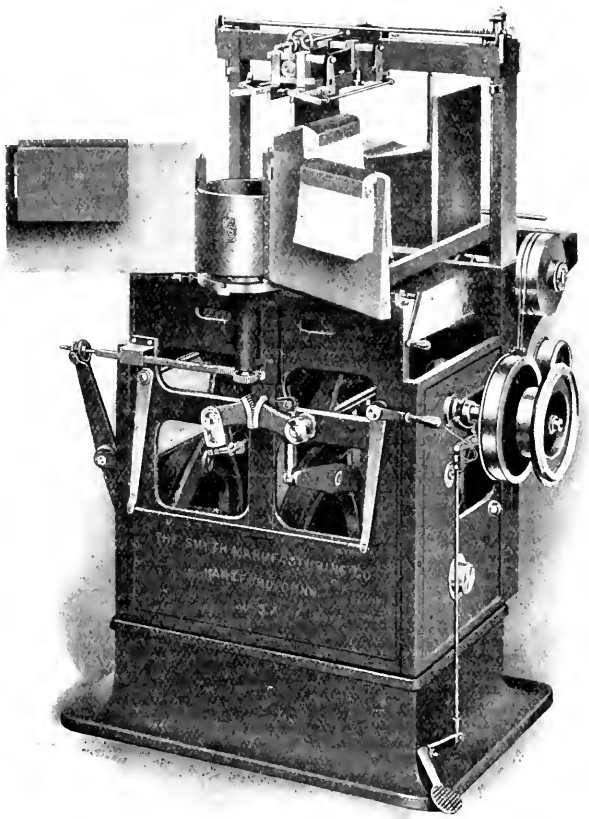

Fig. 68.

taking the paste from the pendent extension, the latter makes a slight downward movement so that a small quantity of paste is deposited on the top edge of each pasting plate, which is grooved. While these movements are taking place the case is also being prepared for the book. At the rear of the machine is a

cause it to take the exact shape of the "former." The pressure of the inclined blade is then released and the case is further advanced into a position directly above the book, this position being accurately fixed by automatic lays. Thus the book and case are both placed automatically in their correct relative positions. While the case

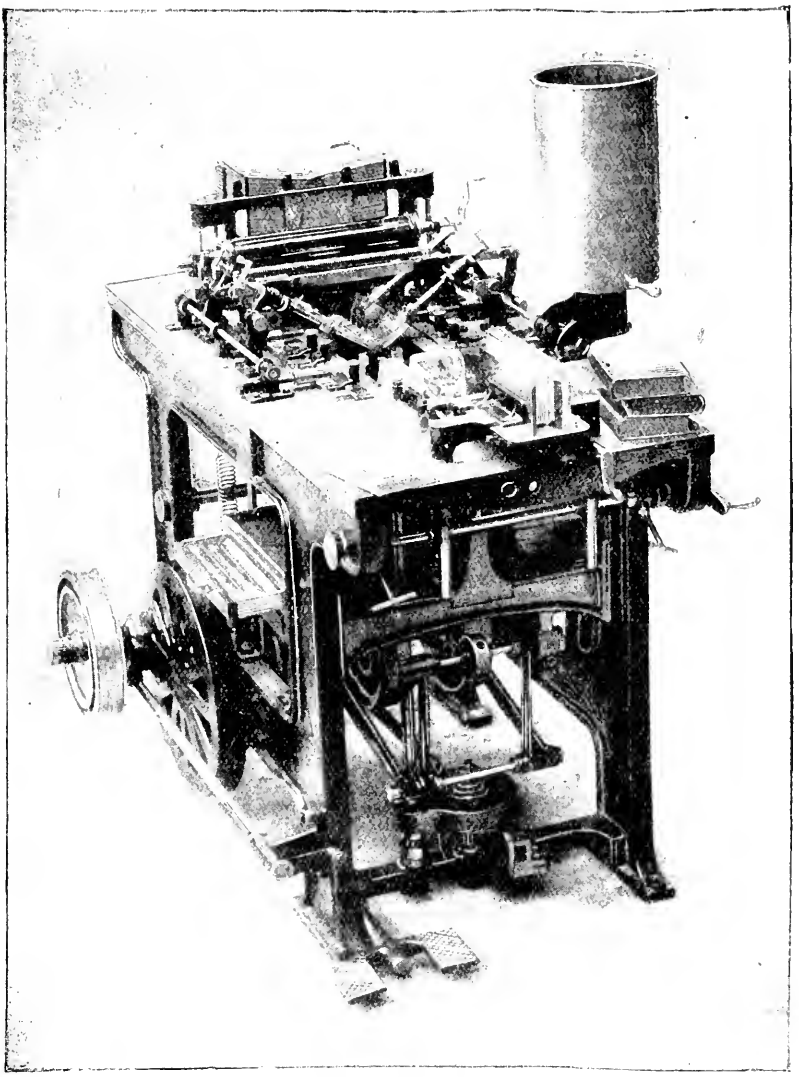

Fig. 69.

is being placed above the book, the book is in its lowermost position, and as it ascends it enters into and lifts the cover, and the cased book is then removed by hand from the knife-edged book-blade.

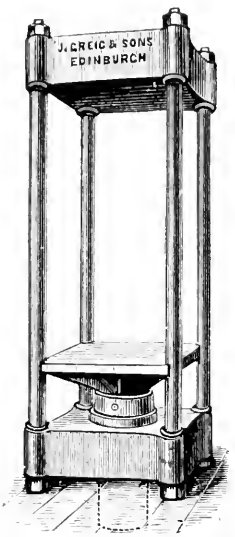

Fig. 70.

The machine is made in three sizes: size No. 1 is a one-size machine made to suit the requirements of Messrs. Thomas Nelson and Sons' Parkside Works; size No. 2 will take cases from $9\frac{3}{4}$ by $14\frac{1}{2}$ inches to 4 by $7\frac{1}{4}$ inches, and the books may range in thickness from $\frac{1}{4}$-inch to 2 inches; size No. 3 will take cases from 14 by 22 inches to $3\frac{3}{4}$ by $5\frac{1}{8}$ inches, and the books may range in thickness from $\frac{1}{4}$-inch to 3 inches. The No. 2 size machine is estimated to give an output of 750 books per hour with one operator, and it is stated that with two operators over 1,100 books have been taken out of this machine. The No. 3 size machine is arranged for working at different speeds, according to the size of the books to be cased. The time occupied in adapting the machine to suit a different size of book to that for which the machine happens to be set is about five or six minutes.

Pressing.

As the books are removed from the casing-in machine they are consigned to the standing press in which they are stacked, the books in each pile usually being arranged with their backs and fore-edges alternating. There are several kinds of standing presses: some of them are worked by different arrangements of cog-wheels, screws and levers, whilst in others the pressure is obtained by hydraulic power. In edition binding hydraulic presses are generally used as they are very capacious, and immense pressure is obtainable in them.

An illustration (Fig. 70) is given of Greig's hydraulic press. It is estimated that over the area of the ram's circle the respective pressures at two tons per square inch are 25 tons for a 4-inch ram, 57 tons for a 6-inch ram, 101 tons for an 8-inch ram, 157 tons for a 10-inch ram, and 226 tons for a 12-inch ram.

After remaining in the press for a few hours the books are removed to receive their wrappers or jackets, and they are then ready for delivery to the publisher.

DEFECTIVE PUBLISHERS' BINDINGS.

The primary desiderata of all books, so far as their physical aspect is concerned, are durability of paper and durability of binding; yet a cursory examination of publishers' books at the present day will reveal the fact that they are the very antithesis of the durable books of earlier centuries. The competition between publishers is so keen that they have been compelled to minimise their expenses in every conceivable way; consequently modern books are usually printed on paper of very poor quality, inferior binding materials are largely used, the machines employed in the different processes of edition binding are rarely permitted to do the good work it is possible for them to perform, and the work is rushed through the bindery with reckless haste. It is not uncommon to find that many modern books are defective because of some of the following causes: 1.—Sewing too loosely. 2.—The use of thread, tape, and mull of inferior quality. 3.—Sewing with the minimum number of stitches on to the minimum number of tapes or cords—or, dispensing with the tapes or cords, and substituting mull of the flimsiest texture. 4.—Fixing the back lining of mull to the book before it has been rounded and backed, and setting the rounding and backing machine inaccurately, thereby rounding the book imperfectly, and breaking many of the strands of the mull and the texture of the paper at the folds. 5.—Tipping the illustrations with paste instead of either guarding them or printing them on paper sufficiently wide to allow the inner margin to be folded round the adjoining section. 6.—The use of inferior glue in glueing-up. 7. The cutting of slips of insufficient length. 8.—Imperfect casing-in, which may be due to the application of an insufficient quantity of paste at the joints, or not setting the book squarely in its cover. 9.—Insufficient pressing immediately after the casing-in operation. 10.—The use of cloth of poor quality, unsuitable ink, and cheap metal foil instead of either gold leaf or suitable ink.

All the operations of forwarding are important and the imperfect execution of any of them will militate against the serviceability of a book, although some of the operations are naturally of more consequence than others. Doubtless book-purchasers generally get good value for their money, but it is patent to the most superficial observer of modern books, and it is appallingly evident to librarians, that there is great need for an improved publishers' binding, or to use the technical term "publishers' casing." Moreover, the fact that an increasing number of publishers are employing artists of distinction to design new book-covers is an additional reason why books should be issued in a stronger binding than is customary at the present time.

SERVICEABLE PUBLISHERS' BINDINGS.

With the object of improving the production of modern books, the Library Association appointed a Book Production Committee, and this Committee has drawn up a series of specifications which it is hoped will be favourably received by publishers when it is issued. There is practical reason why this Committee should be sanguine of success. The Binding Committee of the American Library Association has succeeded in persuading several large publishing firms to issue some of their books in a strong binding at a small extra cost and at the Annual Conference of the American Library Association, held at Lake Minnetonka, in June, 1908 there were exhibited no less than 112 different books in reinforced bindings; some of the books were bound in accordance with a specification of the American Library Association, while others were bound to effect a compromise between the views of the respective publishers and the Association. The Houghton Mifflin Company, of Boston, U.S.A., are to be highly commended on their excellent reinforced binding for *The Leaven of Love* by Mrs. Clara Louise Burnham. This book is sewn "all along" by hand, with Irish linen thread, over three tapes; the first and last sections are reinforced in their folds with strips of linen; and the end-papers are made with cloth joints and sewn through. The extra charge to the trade and to the public for this serviceable binding is 10 cents, the retail price of the ordinary edition being $1.50.

The American Library Association's Committee on Binding has recently issued useful detailed specifications in the hope that American publishers will pay more attention to the question of binding than they have done in the past, and that such consideration will result in a general improvement in the methods of edition binding; by permission of the Chairman of the Committee these specifications are printed herein as an appendix (pp. 55–56). It should be noted that this Committee attributes responsibility for inferior work to the publishers and not to the binders, who, of course, estimate for that for which they are asked.

Up to the present no English publisher has been enterprising enough to emulate the example of the American publishers of supplying a strong "cased" book in original covers at slightly increased cost, but a praiseworthy step has been taken by the firms of Henry Frowde and Hodder and Stoughton; these publishers have combined for the purpose of issuing a large number of books for children in a special library binding, and they have already issued a separate catalogue of such books. The books are bound from the sheets and the essential features of the binding are:—

(a) The first and last sections are lined in their folds with jaconet.

(b) The books are machine-sewn, three tapes being used for a crown 8vo.

(c) The books have special linen joints, for which a patent has been applied for.

(d) The books have tight or loose backs, according to the quality of the paper.

(e) The books are bound in quarter pigskin or in half pluviusin, as desired.

The writer has been assured by the publishers that as soon as possible the plates for books in this library edition will be printed on paper sufficiently wide to allow of their being folded round the adjoining section. The prices of books in this special binding compare favourably with those of the public library binders who make a speciality of binding from the sheets for libraries; a book published at 6s. may be obtained in quarter pigskin for 5s. 6d. net, or in half pluviusin for 5s. net, and a 3s. 6d. book is supplied in quarter pigskin for 3s. 8d. net, or in half pluviusin for 3s. 2d. net. The books are plainly but neatly finished.

There is considerable difference of opinion amongst librarians as to the desirability of having books bound from the sheets in a special library binding, chiefly because comparatively few books are published of which the popularity can be so gauged as to justify the extra expense such a binding would entail. While it may be economical to have some books of assured popularity bound from the sheets in leather or other expensive material, it is not desirable to purchase the great majority of books in an expensive binding. Therefore, greater attention should be devoted to the improvement of the "cased" book on the lines of the specifications of the American Library Association, or those to be published by the English Library Association, so that for a few pence extra a book could be obtained in a serviceable binding that would guarantee its circulation at least sixty or seventy times. Before publishers will agree to issue books in a special library binding they will naturally expect to be assured that a certain minimum number of copies would be ordered. If such an assurance could not be given them by the Library Association at present, a way out of the difficulty might be found if a large firm of booksellers undertook to provide the special library bindings. As an experiment such a firm could purchase about two hundred copies of a book of assured popularity, and bind them according to a specification of the Library Association for an extra cost of about sixpence per copy. This sum would be sufficient to allow the book to be bound satisfactorily and to have a durable cloth, such as that selected by the United States Bureau of Standards, a sample of which is used on the cover of this book; the specification of this cloth will be found on page 57.

That publishers' bindings do not meet present requirements is a truism; improvements have been suggested, and it is hoped that the publishers will not be slow to produce their books in a manner that would redound to their credit and give complete satisfaction to their customers.

APPENDIX I.

AMERICAN LIBRARY ASSOCIATION. Committee on Binding.

Binding Specifications for Commercial Work.

To the Publishers:

On account of the widespread complaint that the modern commercial methods of binding books are not satisfactory from the standpoint of use in public libraries, the Committee on Binding of the American Library Association has investigated the question with a view to submitting specifications for binding which would add but little to the cost of any book, but which would add greatly to its serviceability.

The responsibility for poor binding seems to rest with the publishers. The binders have sufficient knowledge, use up-to-date machinery, and in most cases would prefer to do creditable work. On account of the pressure which publishers have brought to bear on them, however, prices have been reduced to such an extent that binders have been obliged to slight their work in order to compete with other binders. Moreover most publishers take no interest in the processes of binding and in asking for bids make no specifications other than the colour and the quality of cloth, and the nature of decorative design to be used. From the standpoint of serviceability these are the least important items and the binder is left free to use poor thread, poor glue, poor back-lining paper; wide opportunity is given to cheapen the work all along the line. The result may be seen in every public library in the country, where all cloth-bound books must be withdrawn from circulation and sent to the bindery when they have been in the hands of less than twenty readers. Larger books of travel, history, etc., can seldom be issued more than ten times before being rebound, and it is not uncommon to have them part from the covers before being in the hands of five readers.

It is admitted that a fixed standard of binding for all books is impossible since books vary so much in quality of paper, in size, in thickness and number of signatures, but it should be the duty of publishers when asking for bids to take these matters into account, since the serviceability of books is so vitally affected. A re-bound book is much less attractive than one in the original cover and an unattractive book in a public library is as much to the detriment of the publisher as it is to the library.

Specifications.

Paper.

(a) Thick heavily loaded or spongy papers should never be used for books that are likely to receive service in public libraries. While there may be many exceptions, it may be confidently stated that a 70 pound 24 by 36 paper folded with the grain should give the best results.

(b) Most books should be printed on signatures of not more than 16 pages. Thin, light-weight paper sometimes works well in 32-page sections, but 64 pages should never be used.

(c) Illustrations should, if possible, be printed on a tough paper with an inside margin wide enough to allow folding around the adjoining signature. If illustrations are printed on brittle paper they should be guarded with tough thin paper and the guard either folded around and sewed through, or folded over and pasted to adjoining signature.

Sewing.

(a) Ordinary machine sewing should be used. Books weighing over two pounds should be sewed on tapes, but not through them.

(b) Use 4 cord best quality cotton thread. Size of the thread depends upon the size of the book, quality of paper, thickness and number of sections. Thread used on the ordinary novel of 350 to 500 pages should have a tensile strength of at least 7½ pounds, when tested double with a thread tester.

(c) As many stitches as the back of the book will allow should always be used. They should not be more than one inch apart and should come within ¼ of an inch of the head and tail of the book. For economy's sake binders sometimes leave out one or two stitches. This always weakens the book.

(d) A book should always be sewed all along, never "on and off," except with a book having a large number of thin sections. Binders sometimes sew "on and off" for the sake of economy since it saves thread.

(e) Proper tension should be used so as to sew the book neither too tight nor too loose. The books should be just loose enough so that all looseness will be taken up in rounding and backing the book. If it is sewed too tight, rounding the book tends to tear the paper and break the thread. In order to get production when using inferior thread employers allow operators to loosen up on the tension. This, of course, should not be allowed.

(f) All work should be carefully done and only expert operators employed.

Forwarding.

(a) Flat backs should never be used. It is impossible to make a good joint on flat-backed books. The joint is one of the most important parts of the book.

(b) All books should be carefully and uniformly rounded and backed. Machines should be carefully adjusted. Otherwise, attempts to get large production will result in poor work, since the machines, if not properly handled, tend to break the thread and to crush and break the paper in the folds

(c) Only the best quality of glue suitable for binding should be used. At present prices it should cost not less than 15 c. a pound by the barrel. The difference in cost between suitable glue and a cheaper glue is not great, since the higher-priced glue covers more surface than the other. In applying the glue care should be taken to see that the coating is thin, even and a small quantity gets in between the sections. Care should be taken not to boil the strength out of the glue and glue pots should be cleaned at least once a week.

(d) Best quality of super should always be used. On books weighing over 1½ pounds unbleached muslin or some other material stronger than super should be used. Care should be taken to have the super or muslin wide enough so that it will cover an inch on the inner margin of each board when the book is cased in.

(e) It is the practice of many binders to use waste papers, even newspapers for back lining. The best quality of regular back lining paper should always be used and cut so that the grain runs from the head to the tail of the book, not from side to side.

(f) Covers should fit perfectly and great care used in forming the joint. In "casing-in" paste should be applied clear up to the joint and to the extreme ends, particularly at the joint. Covers should be forced well into the joint. The cover will thus be fastened to the book its entire length at the joint. This is perhaps the most important point affecting the serviceability of books. It is the present custom in "casing-in" not to paste clear up to the joint nor to the extreme ends of the book. The reason for this is that when the book is put in the press the pressure tends to force the paste out at the end or through the cloth and the book has to be cleaned off. It is confidently stated, however, that no book that does not have a good joint will be serviceable.

(NOTE. The Committee is informed that there are casing-in machines which do this work more satisfactorily than it can be done by hand, but it has had no opportunity to watch the machines in operation nor to examine books cased in this way after they have seen service in libraries.)

(g) Books should be put in the press immediately after "casing-in" and allowed to remain under heavy pressure until dry.

It will be noted that these specifications are in the main general rather than specific, and aim to call the attention of publishers and binders to important items. It is not the purpose of the Committee on Binding to dictate to binders how details of processes should be performed. The strength of a book depends in a large measure upon technical details, and specifications for such details cannot be formulated satisfactorily by those who have not had practical experience. It is assumed that in all commercial work binders will bind each book on its merits and will vary details according to the particular requirements of the book in hand.

The A.L.A. Committee on Binding hopes that every publisher receiving these specifications will give them careful consideration. No specification has been included unless it has had the approval of experts outside of the Committee. While each specification is important and affects most materially the serviceability of the books, the Committee feels that a faithful adherence to specification "f" under Forwarding would do more to increase the serviceability of books than any one change from the universal custom.

ARTHUR L. BAILEY, Chairman,
Wilmington (Del.) Institute
Free Library.

June 9th, 1909.

APPENDIX II.

UNITED STATES Government Specifications FOR BOOK CLOTH.

As a result of numerous protests against the binding of Congressional documents and reports in full sheep, which material has proved undurable, the Bureau of Standards, Washington, made various chemical and physical tests of twenty-three samples of cloths and buckrams, and issued a report in 1908. The following specifications for book cloth were subsequently formulated by the Bureau of Standards, and the material now used by the United States Government for the binding of public documents conforms to these specifications:

Fabric.

The fabric shall be made from first quality, staple cotton, uniformly woven and of a grade known, as "firsts." The weave shall be two up and two down in the warp, and one up and one down in the weft.

The grey cloth shall consist of from 33-36 threads per centimetre (85-90 per inch) in the warp, and 12-15 threads per centimetre (30-38 per inch) in the weft.

The surface shall be finished smooth and hard and show no tendency to stick when folded upon itself.

Thickness, Tensile Strength and Weight.

The thickness of the finished fabric shall not exceed .30 millimetre (0.012 inch) or be less than .20 millimetre (0.008 inch). The tensile strength of the grey cloth shall not be less than 18 kilogrammes per centimetre (100 lbs. per inch) of width in the warp and 9 kilogrammes per centimetre (50 lbs. per inch) of width in the weft. The average value for the warp and weft in the finished fabric must show an increase over the average value for the warp and weft in the grey cloth, of at least 10 per cent. of the strength of the grey cloth.

The finished fabric, when dry, shall weigh not more than 200 grammes per square metre (0.5 lb. per square yard) or less than 200 grammes per square metre (0.4 lb. per yard).

Absorption of Moisture.

At a normal relative air humidity of 65 per cent. it shall not absorb more than 5 per cent. of moisture, or expand (an average of both directions) to exceed .45 per cent., and when subjected in a closed case to a saturated atmosphere, for two hours, at a temperature of 20° C. (68° F.), shall not absorb more than 10 per cent. of moisture, or expand (an average of both directions) to exceed 2 per cent. All increases to be computed on the basis of the dry weight and dimensions.

Folding Endurance.

The folding endurance as determined by the Schopper folder shall be not less than 65,000 double folds for the warp, and not less than 10,000 for the weft.

Colour.

Before coating, the fabric must be dyed with a purely mineral or morganic colour (such as iron salts), so as to imitate the colour of the finished cloth, but somewhat lighter in shade, so as to give the desired "linen" effect. All coal-tar, aniline, vegetable or other organic dyes and lakes must be strictly excluded from both fabric and coating, even in traces. The following substances must be also excluded: Chrome yellow and other chromates, ultramarine, browns containing bituminous or other organic matter, compounds of lead and arsenic.

The colour of the finished fabric should be slightly darker than the standard sample which will be furnished on application, and it must not show the slightest change of colour after exposure under prescribed conditions to direct sunlight, or to the action of ammonia gas, sulphuretted-hydrogen gas, sulphur-dioxide gas or illuminating gas.

Resistance to Mould and Insects.

The finished fabric shall be immune to the growth of mould or the attack of insects.

NOTE.—For the present some latitude will be allowed in the enforcement of this requirement, since definite knowledge of the causes and the methods of prevention are still lacking. Experiments have shown that book cloths have been produced which meet the requirements.

Tests.

Physical and chemical tests to verify the properties required by these specifications will be made according to the standard methods for testing book cloths as used by the Bureau of Standards, copies of which can be obtained on application.

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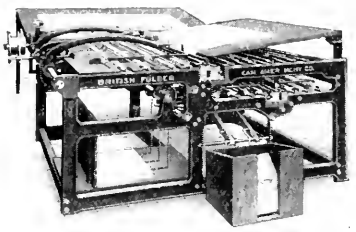

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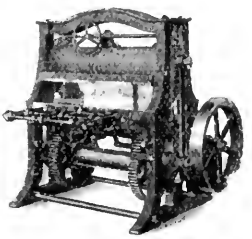

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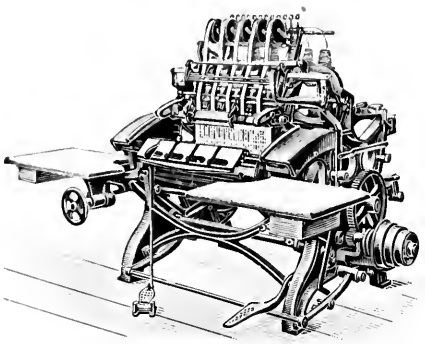

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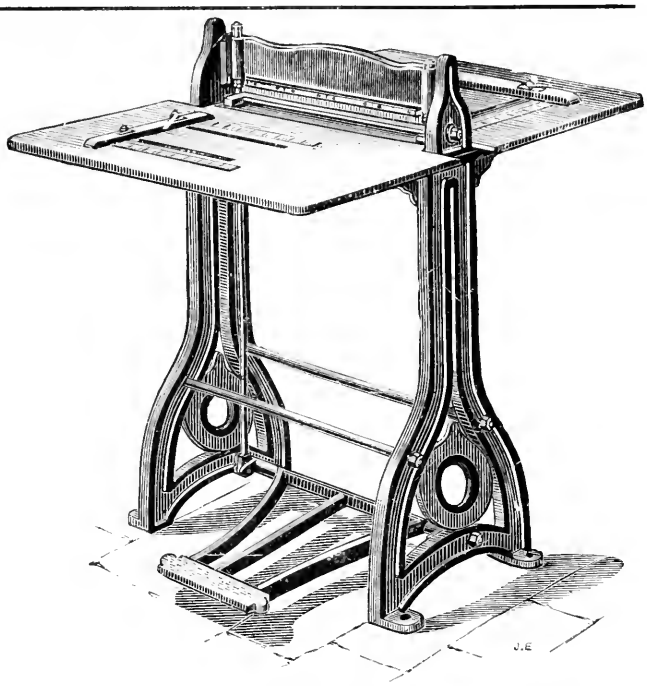

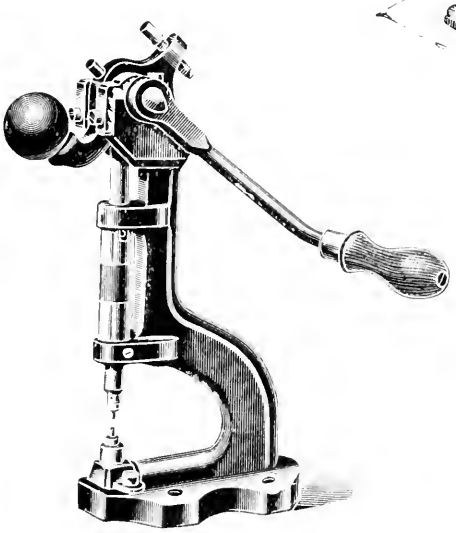

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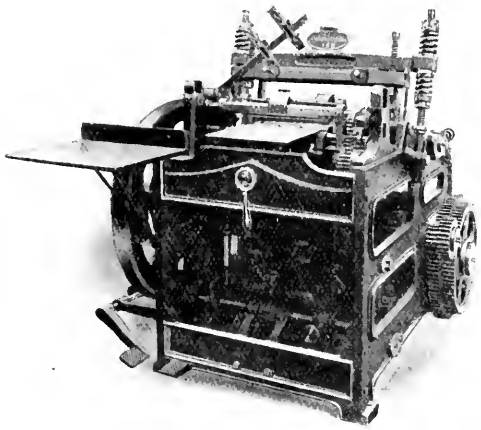

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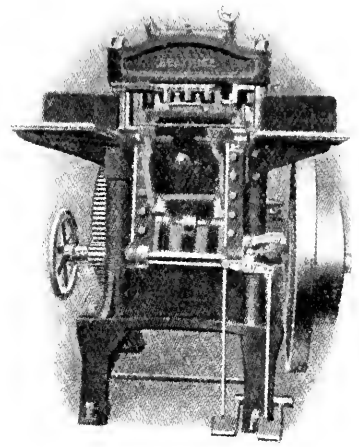

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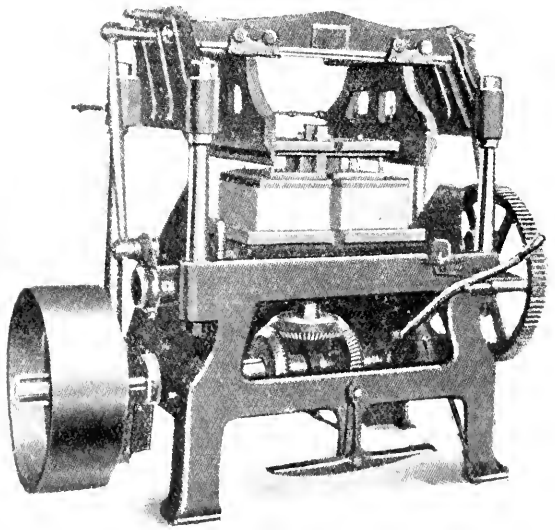

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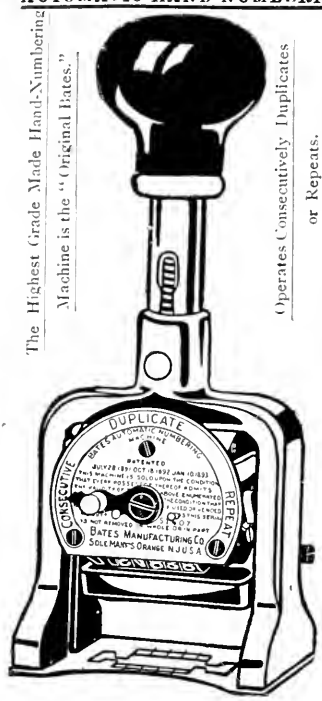

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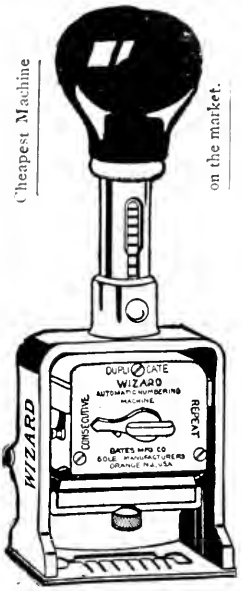

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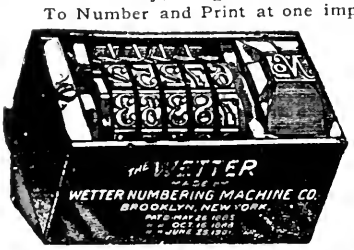

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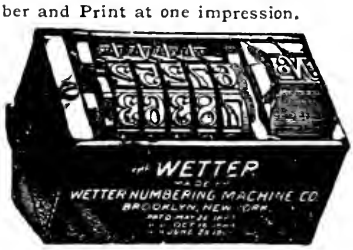

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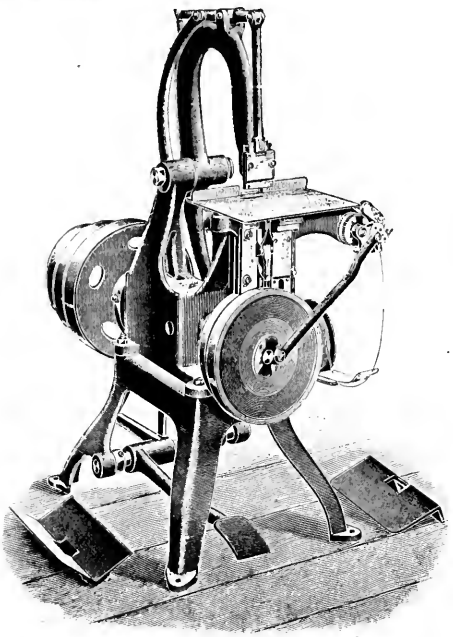

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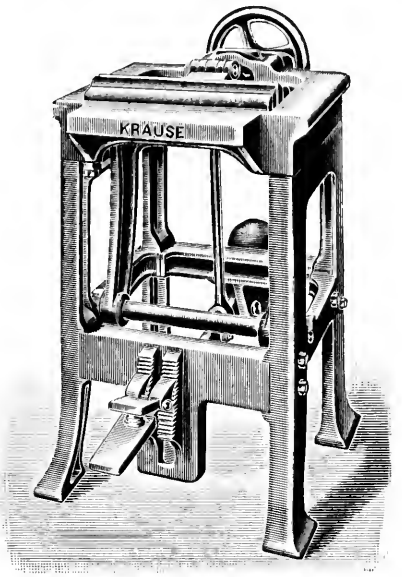

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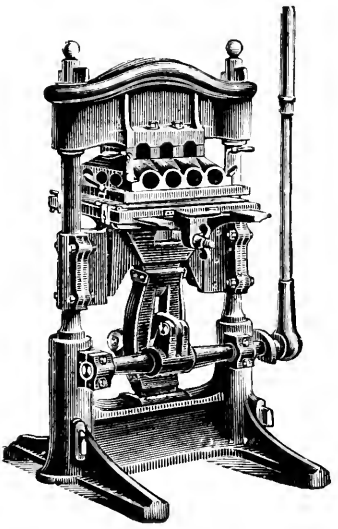

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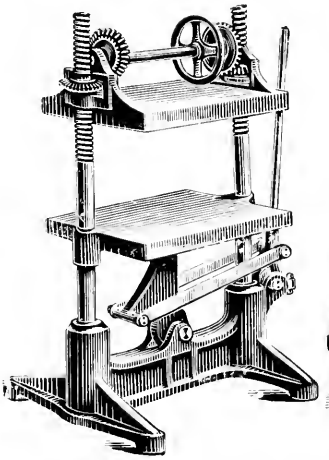

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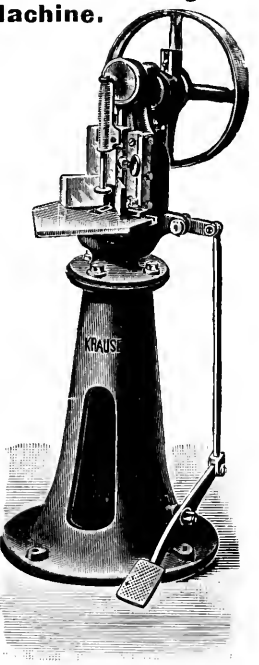

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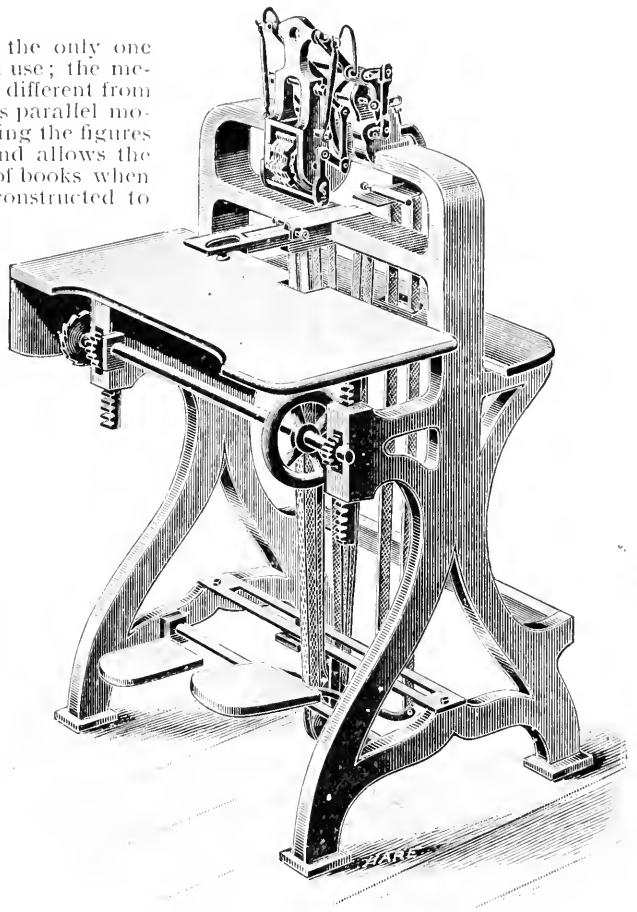
Improved Paging & Numbering Machine



THIS Paging Machine is the only one of its class at present in use; the mechanical principle is entirely different from any other in the market. Its parallel motion causes the head containing the figures to recede at each stroke, and allows the operator to turn the pages of books when numbering. The head is constructed to give as little shake or vibration as possible. All the wearing parts are made of the very best tool steel, and the quality of the workmanship surpasses anything in the numbering machine line. The Machine can be set to repeat any figure, or set of figures, any desired number of times; we usually supply four cams or repeating mechanism with each Machine, which enables the operator to number consecutive, alternate, duplicate, triplicate, and quadruplicate figures. Extra mechanism to repeat up to 20 times will be supplied, if desired, at a small additional cost.

A long Smut Band is supplied with each Machine, which works automatically after each stroke and ensures a clean impression.

At an extra cost we supply an Appliance that takes the place of a letter wheel, and also saves the disconnecting of the wheels—the removal of one wheel and replacing of another—as there are three wheels needed for the whole alphabet. The new Attachment being automatic, has also the advantage of being in juxtaposition with the number in every case, whether composed of one figure or many figures. The letters will always print in their proper places, and every change is made automatically without stopping machine.

The difficulty with movable ciphers is that each time a new decimal is reached, the serial letter must be removed from the zero place of one wheel and inserted in the zero place of the next to the left. This new Serial Alphabet Attachment can be fitted to any of our paging wheel sets, either for single or double head machines. It is necessary to have the old wheels sent to us to have the Attachment accurately fitted.

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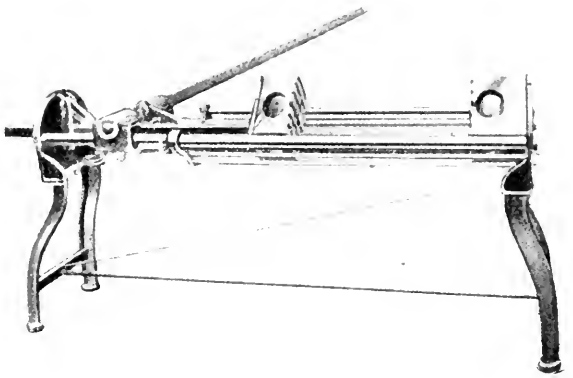
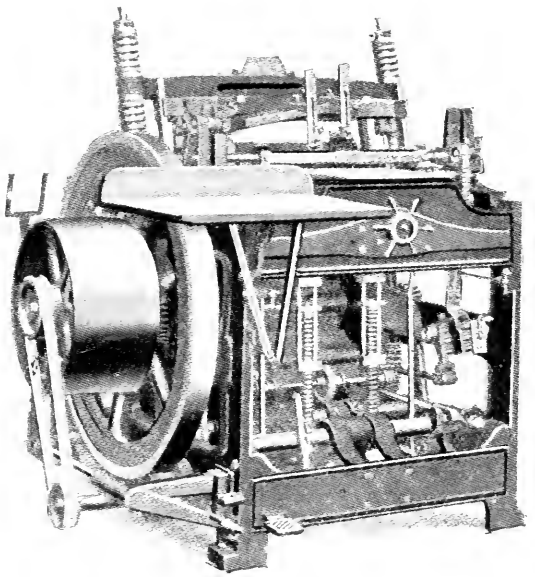


CRAWLEY BUNDLING PRESS No. 358.

For compressing and tying up, so as to store in minimum space and protect from dirt, printed folded sheets. It has many advantages over the Power Bundling Presses, costs nothing to run except the wages of the operator, occupies less space and weighs less.



CRAWLEY ROUNDING and BACKING MACHINE No. 357.

This machine is in use in all the principal binderies throughout this country and America, and is too well known to need description.

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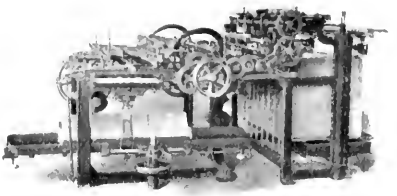
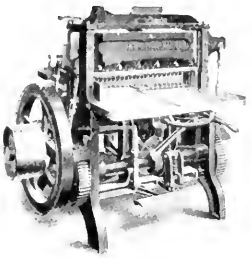


"Dexter" Double-16 Folder and Feeder.



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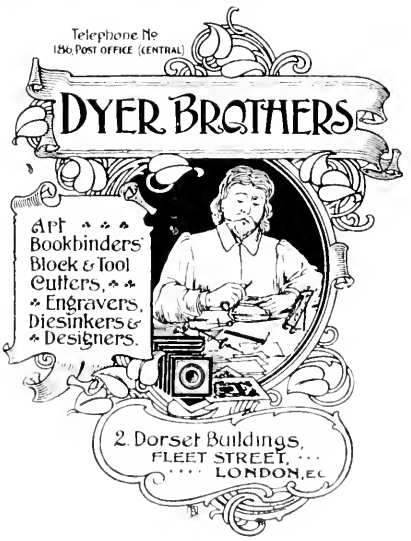

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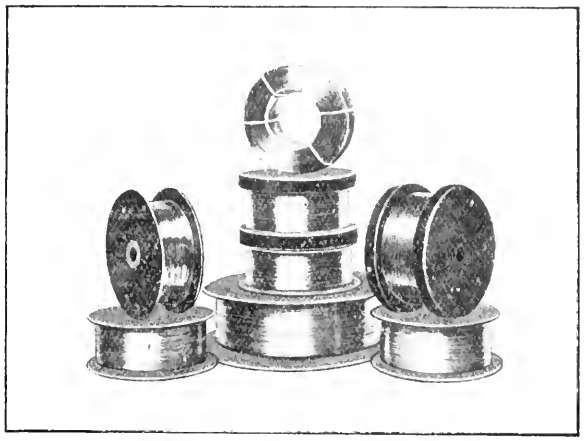

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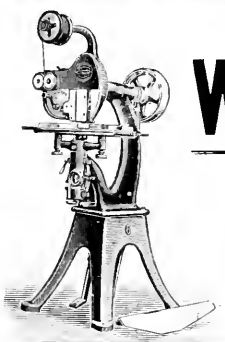

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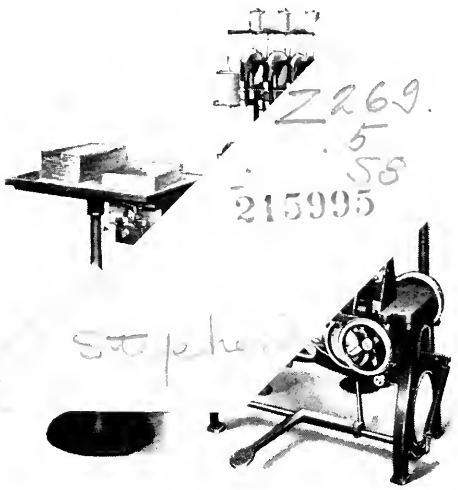

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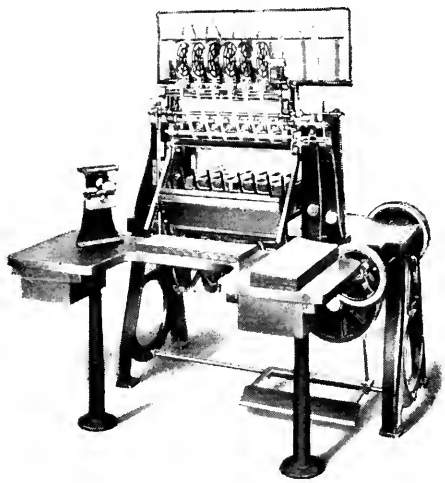

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